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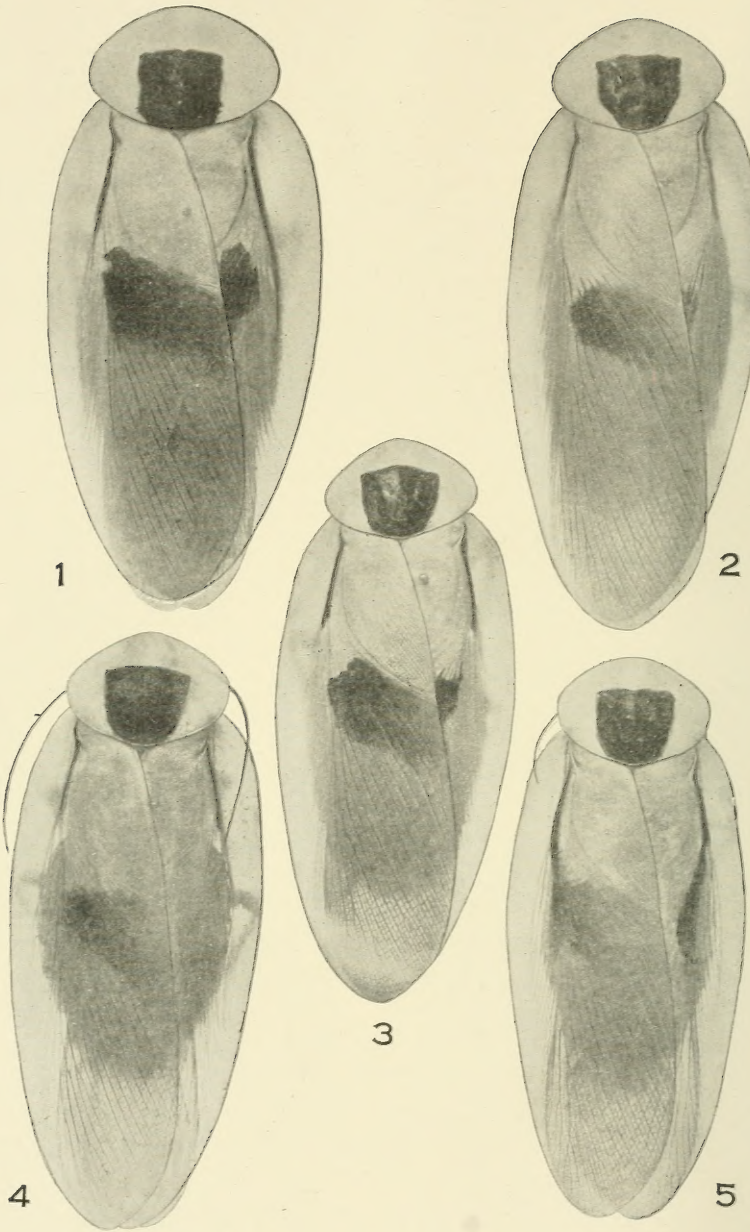


BLABERUS GIGANTEUS, 1; B. COLOSSEUS, 2-5.—HEBARD.

# ENTOMOLOGICAL NEWS

AND

## PROCEEDINGS OF THE ENTOMOLOGICAL SECTION

ACADEMY OF NATURAL SCIENCES, PHILADELPHIA.

VOL. XXVII. JULY, 1916. No. 7.


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## Critical Notes on Certain Species of the Genus Blaberus (Orthoptera, Blattidae).


By MORGAN HEBARD, Philadelphia, Pa.


(Plate XV.)

Recently, in studying the species of the present genus adventive in the United States, it was found necessary to examine all of the material of the genus in the Philadelphia collections and to consider carefully the literature on the subject, before these forms could be properly located. But two, *B. colosseus* (as the synonymous *mexicana*) and *B. discoidalis* (as the synonymous *cubensis*), have been recorded from this country; confusion of the first of these with the closely related *B. giganteus* has made necessary a full discussion of that species as well.

The following discussion is based upon more extensive series of the species involved than have ever been assembled at one time in the past.

**Blaberus giganteus** (Linnaeus). (Plate XV, fig. 1).

1758. *B*[*latta*] *gigantea* Linnaeus, Syst. Nat., Ed. X, I, p. 424. [America.]

1813. [*Blatta*] *gigantea* Stoll, Natuur. Afbeeld., Kakkerlakken, p. 2, Register p. 1, pl. Id, figs. 1 and 2. (No locality given.)

1865. *Bl*[*abera*] *stolli* Brunner, Nouv. Syst. Blatt., p. 374. [♀, Cayenne, [French Guiana].]

This species is closely related to *B. colosseus* (Illiger), differing in the distinctly broader form. The broader pronotum has, in the female sex,[1] the cephalic portion more ample, the curvature laterad of the cephalic margin less decided, thus leaving distinctly more extensive lateral margins which are subparallel for a short distance (as described for *gigantea* by Illiger). In our material the length of the pronotum is contained in its width 1.49 to 1.5 times (Saussure gives for this species 1.48 to 1.50). The tegmina are proportionately broader, with marginal fields distinctly wider, than in *colosseus*. Linnaeus gives "diametro ovi gallinacei" for this species; the series before us of *colosseus* are decidedly too slender to fit this description.

We have given Stoll's reference, as Brunner has described such material as *B. stolli*. We are satisfied that the features given by Brunner for the separation of that condition are of no specific diagnostic value, being due to recessive coloration and slight individual differences in the interocular width and rounding of the apices of the tegmina.

The great size and very pale buffy general coloration of *giganteus* and *colosseus* readily distinguish them from any other species of the genus. Both agree in numerous features of interest given here under the latter species.

*Measurements (in millimeters).*

| ♀ | Length of body[2] | Length of pronotum | Width of pronotum | Length of tegmen | Width of tegmen | Width of costal field | Length in width of pronotum |
|---|---|---|---|---|---|---|---|
| Cincinnati, Colombia | 66.0 | 17.3 | 25 8 | 66.8 | 25.2 | 8.3 | X 1.49+ |
| Cincinnati, Colombia | 58.2 | 17.2 | 25.7 | 66.2 | 25.8 | 8.4 | X 1.5 + |
| Cincinnati, Colombia | 63.0 | 16.6 | 25.0 | 65.3 | 25.0 | 8.0 | X 1.5 |

[1]Lack of males of the present species is unfortunate, but it is probable that the contrast between the sexes in *giganteus* is in every way comparable with that found between the sexes in *colosseus*.

[2]The body measurement is taken to the apex of the subgenital plate; the supra-anal plate, in the present genus, extends beyond this point.

*Coloration.* General color of pronotum and tegmina cinnamon buff. Pronotum with a large polished blackish brown mesal spot, which narrows slightly caudad and is in full contact with the caudal margin of the pronotum.[3] Tegmina with proximal fifth of humeral trunk blackish brown; a broad band of warm sepia crosses the exposed proximal portions of the discoidal fields of the tegmina when at rest; the distal portion of the discoidal field of the sinistral tegmen, exposed when at rest, is again suffused, but less heavily, with snuff brown. Dorsal surface of abdomen shining blackish chestnut, margined laterad with cinnamon buff, all but a brief basal portion of the supra-anal plate of this color. Underparts and limbs shining blackish chestnut, the ventral surface of the abdomen with medio-lateral spots on the proximal segments and each segment with smaller latero-marginal blotches of yellow-ochre.

The specimens before us undoubtedly represent the intensive coloration of the present species. The insect probably shows all of the color variation, due to recession and intensification, found in the series of *colosseus* before us.

*Specimens Examined*: 6, 5 females, 1 immature male.

Cincinnati, Santa Marta, Colombia, VII, 10, 1913 (M. A. Carriker, Jr.; fundacion), 5 ♀, 1 juv. ♂ [Hebard Cln.].

**Blaberus colosseus** (Illiger). (Plate XV, figs. 2 to 5).

1802. *Blatta Colossea* Illiger, Mag. Insektenkunde, I, p. 186. [Demerara, [British Guiana].]

1862. *Bl*[*abera*] *mexicana* Saussure, Rev. Mag. Zool., 2e Ser., XIV, p. 233. [Mexico.]

1864. *Blabera mexicana* Saussure, Mem. l'hist. Nat. Mex., IV, p. 234. [Tampico, Tuxpan, Cordoba, etc., Mexico; New Orleans, Louisiana.]

Saussure, considering *B. gigantea* and *B. colosseus* synonymous, described *mexicana* in 1862, this name being based on Mexican material showing features of difference from *gigantea* almost exactly as had been described for *colossea* by Illiger. Saussure's more detailed discussion of *mexicana* in 1864 shows convincingly that the name is an absolute synonym of *colosseus*.

[3]In the species of the present genus showing this feature, large series almost always include examples having this spot barely reaching, or entirely failing to reach, the caudal margin of the pronotum. Overestimation of the importance of this mere individual color variation has resulted in a number of decided errors in the past literature.

The present insect is very closely related to *giganteus,* differing chiefly in the distinctly and strikingly more slender form. The less broad pronotum is much more regularly oval and the marginal fields of the tegmina are distinctly narrower in the present species.

Both the present species and *giganteus,* as far as we are able to determine from females, agree in the following characters:

Head with interocular width in males from slightly less than to a full one-fourth the interocellar width, in females from one-fourth to one-third the interocellar width. Head shining blackish, the ocelli and soft portion of clypeus buff. Ocelli with flattened surfaces slanting laterad, the inner margins slightly raised above the flattened plane of the space between the ocelli. Tegmina very ample, rounding broadly distad to distinct but not sharply rounded apex which in position is situated slightly nearer the costal margin. Dorsal surface of abdomen in both sexes with sixth segment strongly acute-angulate produced latero-caudad; seventh much narrower across abdomen and but slightly projecting beyond caudal margin of sixth, with small rounded latero-caudal projections; eighth still narrower across abdomen with caudal margin straight; supra-anal plate strongly quadrate produced, bilobate. Cerci moderately slender, slightly incurved, tapering distad to acute apex, with about seventeen short joints, (in females of *giganteus* twenty to twenty-two); polished and slightly convex above, very hairy and strongly convex below with narrow deep lateral marginal channels. Concealed male genitalia:—Mesad, from above a soft surrounding mantle, a moderately stout short tapering blunt chitinous projection extends caudad; the surrounding mantle having the free dorsal and distal margins fringed with small blunt chitinous projections, these longer and more like short blunt teeth of a comb on the sinistral margin. Dextrad of this organ, from a broad chitinous base, a stout subchitinous shaft is directed caudad curving regularly outward, the convex surface is subchitinous, the inner surface soft, the apex more chitinous and flattened, broadened and blunt. Male subgenital plate convex, asymmetrical, distal margin broadly convex from sinistral base to mesal portion of distal half, there rounding sharply into deep concave emargination at dextral base, within which the margin is much softer and subchitinous. Minute slender cylindrical styles present on this margin at the inner bases of the cerci, the sinistral five times as long as broad and situated in a small indentation of the external surface near the margin, the dextral eight times as long as broad and situated in a more decided indentation of the margin itself. Ventro-cephalic margins of cephalic femora supplied proximad with three or

four short stout widely spaced spines, succeeded distad by a close set row of short stout hairs, these terminated distad by a single short stout spine; ventro-caudal margin of cephalic femora and ventral margins of other femora supplied with a similar single distal spine. Median and caudal femora armed in addition with a single longer geniculer spine.

*Measurements (in millimeters).*

| ♀ | Length of body | Length of pronotum | Width of pronotum | Length of tegmen | Width of tegmen | Width of marginal field | Length in width in pronotum[4] |
|---|---|---|---|---|---|---|---|
| Caparo, Trinidad | 58 3 | 16.8 | 22.0 | 69.6 | 22.4 | 6.3 | X 1.31 |
| Caparo, Trinidad | 56.6 | 15.6 | 20.7 | 63.8 | 21.3 | 5.6 | X 1.33— |
| Caparo, Trinidad | 57.0 | 15.0 | 20.0 | 64.3 | 21.0 | 6.2 | X 1.33+ |
| Gorgona, Panama | 53.6 | 15.6 | 22.7 | 63.0 | 22.3 | 7.0 | X 1.46— |
| St. Jean, French Guiana | 58.8 | 15.7 | 22.2 | 70.7 | 25.2 | 7.6 | X 1.41+ |
| ♂ | | | | | | | |
| Guatemala | 54.6 | 14.3 | 20.2 | 53.8 | 20.7 | 6.0 | X 1.41+ |
| San Carlos, Costa Rica | 59.6 | 16.0 | 23.2 | 67.7 | 24.5 | 7.7 | X 1.45 |
| Costa Rica | 58.7 | 16.9 | 24.6 | 70.8 | 24.8 | 7.0 | X 1.45— |
| San Esteban, Venezuela | 64.0 | 16.0 | 22.8 | 69.4 | 25.0 | 6.3 | X 1.43— |
| San Esteban, Venezuela | 60.0 | 14.9 | 20.7 | 64.7 | 22.9 | 6 3 | X 1.49— |
| Maroni River, Fr. Guiana | 59.0 | 16.6 | 23.7 | 68.4 | 26.2 | 7.0 | X 1.43— |

*Coloration.* In intensive examples (Costa Rica) exactly as described under *giganteus.* Through recessive stages first the distal suffusion of the tegmen disappears (Trinidad), then all markings except the blackish brown proximal fifth of the humeral trunk. In the condition of maximum recession (majority of Trinidad material) the pronotal margins are warm buff, the tegmina clear transparent warm buff with but small dashes of blackish brown at base of humeral trunk. Three recessive examples before us (Trinidad) have two dots of zinc orange mesad in the pronotal spot, while an intensive specimen (Costa Rica) has four of these dots. The pronotal spot is often in full contact with the caudal margin of the pronotum, usually it is distinctly narrowed there, while in a few specimens it fails to reach that margin by a narrow interval.

*Specimens Examined*: 23, 16 males, 7 females.

Olas de Moka, Solola, Guatemala, 3,000 feet, IX, 1908, 1 ♂, [U. S. N. M.].

Senahu, Alta Vera Paz, Guatemala, (P. Haase), 1 ♂, [U. S. N. M.].

Guatemala, 1 ♂, [Am. Mus. Nat. Hist.].

San Carlos, Costa Rica, (Schild-Burgdorf), 2 ♂, 2 ♀, [U. S. N. M. and A. N. S. P.].

Costa Rica, (M. A. Carriker, Jr.), 1 ♀, [Hebard Cln.].

Gorgona, Canal Zone, Panama, 1 ♂, [A. N. S. P.].

[4]Saussure gives for his material, the length contained in the pronotal width, in *giganteus* 1.48 to 1.50, in his *mexicana* (synonym of *colosseus*) 1.40 to 1.45.

Ancon, Canal Zone, Panama, 1 ♂, [U. S. N. M.].

San Esteban, Venezuela, X to XI, 1910, (M. A. Carriker, Jr.), 2 ♀, [A. N. S. P.].

Cerro Aripo, Trinidad, VIII, 1909, (M. A. Carriker, Jr.), 1 ♂, [A. N. S. P.].

Caparo, Trinidad, VI, 1913, (H. S. Parish), 1 ♂, [A. N. S. P.]; VIII, 1913, (H. S. Parish), 7 ♂, [Hebard Cln.].

St. Jean, French Guiana, (W. Schaus), 1 ♂, [U. S. N. M.].

Maroni River, French Guiana, (W. Schaus), 1 ♀, [U. S. N. M.].

**Blaberus discoidalis** Serville.

1839. *Blabera discoidalis* Serville, Hist. Nat. Ins., Orth., p. 76. [♀, San Domingo.]

1839. *Blabera atropos* Serville, (not *Blatta atropos* of Stoll, 1813), Hist. Nat. Ins., Orth., p. 77. [♂, ♀, San Domingo.]

1839. *Blabera varians* Serville, Hist. Nat. Ins., Orth., p. 78. (In part.) [♂, Cuba.]

1864. *B*[*labera*] *cubensis* Saussure, Rev. Mag. Zool., 2e Ser., XVI, p. 347 [Cuba.]

1865. *Bl*[*abera*] *atropos* Brunner (not *Blatta atropos* of Stoll, 1813), Nouv. Syst. Blatt., p. 375, pl. XII, figs. 55, A to G. (In part.) [♂, ♀; (probably) Jamaica; Venezuela, and Colombia; (probably not) Brazil.]

1868. *Blabera subspurcata* Walker, Cat. Blatt. Br. Mus., p. 4. (In part.) [♂; San Domingo; (probably not) Brazil.]

1894. *Blabera rufescens* Saussure and Zehntner, Biol. Cent.-Amer., Orth., I, p. 119, pl. V, fig. 22. [♀, Cuba.]

In 1839, Serville discussed three supposed species of the genus from the West Indies, describing two of these as new, but stating that all might be varieties of *discoidalis* (in which remark *B. dubia* was included, that species now standing as genotype of *Blaptica*). It is evident that all of his West Indian material, except the female of his *varians,* represents mere color variations of the same species.

In 1864, Saussure described *B. cubensis* briefly, later in the same year discussing the insect more fully, comparing it with his *mexicana* (= *B. colosseus,* see page 291), but evidently overlooking Serville's *discoidalis* and confusing that author's *atropos* and *varians* with *atropos* of Stoll. His species is clearly a synonym of *discoidalis* and later, with Zehntner, he

added another evident synonym, *rufescens,* to the present list, giving for the basis of that name only such characters as slight differences in the shape of the ocular margins and shape of the pronotum to separate it from *cubensis,* features attributable wholly to individual variation within the species.

We find Walker's *subspurcata* to be based primarily on material of the present species, though the Brazilian specimen included probably represents a different form. This name was placed by Kirby under *cubensis* in 1904.

The present insect is the smallest of the North American species of *Blaberus* and is a rather robust species. Decided variation is found in the pronotal form, while the extremes of intensive and recessive coloration are very dissimilar in general appearance.

The following features are of interest:

Head with interspace between eyes in males from one-half to three-quarters the interocellar width (normally three-quarters), in females over one-half to (normally) four-fifths the interocellar width. Head shining blackish, ocelli and soft portions of clypeus buff. Ocelli with flattened surface slanting laterad, the inner margin hardly raised above the very weakly concave surface of the space between the ocelli in males, not at all raised above the deplanate surface of this space in the females. Tegmina very ample but short, reaching well beyond the abdomen in males, very slightly beyond the apex of the supra-anal plate in females; margins distad broadly rounding to distinct but not sharply rounded apex, which in position is slightly nearer the costal margin. Dorsal surface of abdomen much as in *B. giganteus* but with apex of latero-caudal productions of sixth segment much shorter and blunt. Cerci shorter, less tapering and with apex more blunt than in *giganteus,* with about fifteen short joints. Limbs shorter but armament of the same as in *giganteus.*

The extremes in the series from Trinidad are given above. Decided pronotal variation is shown in the material before us, frequently the

*Measurements (in millimeters).*

| ♂ | Length of body | Length of pronotum | Width of pronotum | Length of tegmen | Width of tegmen | Length in width of pronotum |
|---|---|---|---|---|---|---|
| Puerto Plata, San Domingo | 42.1 | 11.9 | 16.8 | 40.2 | 16.3 | X 1.41 |
| Porto Rico | 36 4 | 11.7 | 16.7 | 40.7 | 16.0 | X 1.43— |
| St. Joseph, Trinidad | 44.9 | 12.8 | 17.9 | 43.2 | 16.6 | X 1.4 |
| St. Joseph, Trinidad | 36.8 | 11.6 | 16.7 | 40.1 | 16.4 | X 1.44— |
| Panama | 40.9 | 12.3 | 18.6 | 43.0 | 18.0 | X 1.51 |
| ♀ | | | | | | |
| Puerto Plata, San Domingo | 49.4 | 13.8 | 19.7 | 41.4 | 19.0 | X 1.43 |
| St. Joseph, Trinidad | 51.0 | 13.6 | 19 6 | 40.8 | 17.8 | X 1.44 |
| St. Joseph, Trinidad | 44.0 | 12.7 | 18.8 | 40.6 | 17.0 | X 1.48 |
| Caicara, Venezuela | 43.8 | 12.8 | 18.0 | 38.4 | 15.3 | X 1.41 |
| Panama | 45.1 | 12.4 | 18.3 | 41.8 | 17.0 | X 1.47 |

two sides will be produced in slightly different degree or form.

*Coloration.* Pale portions of pronotum warm buff (recessive) to clay color (intensive). Pronotal spot with caudal margin nearly two millimeters distant from caudal margin of pronotum (maximum recessive), grading through every degree to a great roughly quadrate blotch in full contact with caudal margin of pronotum (maximum intensive). In the maximum recessive coloration the tegmina are transparent light ochraceous buff, with humeral trunk blackish brown for one-third the tegminal length; our series shows every degree of intensification to one in which the anal and narrow lateral portion of marginal and scapular fields are cinnamon buff, the humeral trunk blackish brown with this color spreading out beyond the anal fields, the remaining distal portions of the tegmina, exposed when at rest, deep chestnut brown. The portion of the dextral tegmen, concealed when at rest, has a faded and more buffy appearance. The wings are usually weakly suffused with brown, but in specimens of maximum intensive coloration this suffusion is rather decided and more pronounced in the anterior field. Even in the maximum recessive color condition the limbs remain shining very dark brown, the underparts much suffused with this color.

*Specimens Examined*: 28; 10 males and 18 females.

Puerto Plata, San Domingo, IV, 7 and 8, 1915, 1 ♀; VII, 6, 1915, 1 ♂, [both Am. Mus. Nat. Hist.].

Porto Rico, 1 ♀,[6] [A. N. S. P.].

Vieques Island, Porto Rico, II, 1899, (A. Busck), 3 ♀, [U. S. N. M.].

Kingston, Jamaica, VIII, 1, 1913, (W. Harris), 2 ♂, 6 ♀, [U. S. N. M.].

St. Joseph, Trinidad, XI, 9, to XII, 10, 1915, (R. A. Wood), 3 ♂, 5 ♀, [Hebard Cln.].

Diego Martin, Trinidad, VI, 21, 1915, (R. A. Wood), 2 ♂, [Hebard Cln.].

Caicara, Rio Orinoco, Venezuela, 1 ♀, [A. N. S. P.].

Porto Bello, Panama, (A. H. Jennings), 1 ♂, [U. S. N. M.].

Panama, (H. E. Wetherell), 1 ♂, 1 ♀, [A. N. S. P.].

EXPLANATION OF PLATE XV.

Dorsal view. (Natural size.)

Fig. 1. *Blaberus giganteus* (Linnaeus). Female. Cincinnati, Santa Marta, Colombia.

Fig. 2. *Blaberus colosseus* (Illiger). Female. San Esteban, Venezuela.

Fig. 3. *Blaberus colosseus* (Illiger). Male. San Esteban, Venezuela.

Fig. 4. *Blaberus colosseus* (Illiger). Male. Caparo, Trinidad.

Fig. 5. *Blaberus colosseus* (Illiger). Male. Caparo, Trinidad.

[6]Recorded by Rehn as the synonymous *B. rufescens* in 1903.

# The Lines of Descent of the Lower Pterygotan Insects, with Notes on the Relationships of the other Forms.

By G. C. Crampton.*

(Continued from page 258)

The interrelations of the different groups making up the section Neuropteradelphia are extremely complicated, and can be worked out in detail only after studying more of the primitive and annectent forms than are at present accessible. Enough material is available, however, to indicate the following relationships.

The Raphidoides (*Aponeuroptera*) or Raphidian group is closely related to the Sialid group, but has tended to branch off along its own line of development. The Sialoides (*Meganeuroptera*) or Sialid group comprises such insects as *Sialis, Corydalis, Chauliodes,* etc., and is one of the most primitive of the Neuropteroid section, forming one of the main trunks upon which the other lines of descent converge. This group contains some of the largest of the Neuropteroid forms (hence the name *Meganeuroptera*).

The Chrysopoides (true *Neuroptera*) or Chrysopid group comprises such forms as the Chrysopidae, Hemerobiidae, Coniopterygidae, etc., and is rather closely related to the Sialid group, the two together constituting the most primitive lines of Neuropteroid insects.

The Myrmeleonoides (*Zygoneuroptera*) or Myrmeleonid group is related to both the Sialid and Chrysopid groups and has retained certain characters suggestive of a relationship to the Zygoptera, or Libellulid forms. This group contains such insects as the Myrmeleonidae, Ascalaphidae, *Nymphes,* etc., all of which are quite primitive forms, so that it is rather difficult to determine which of the three groups (Sialids, Chrysopids or Myrmeleonids) is the most primitive, although the Sialids are apparently as little modified as any.

The Mantispoides (*Dictyneuroptera*) or Mantispid group is related to the Chrysopid group, and also shows some affinities

* Contribution from the Entomological Laboratory of the Massachusetts Agricultural College, Amherst, Mass.

with the Panorpid group, which is also rather distantly related to the Chrysopid group. These insects (e. g., *Mantispa*) resemble Mantids in some respects, but the relationship between the two is not very close—although the Mantids are distantly related to them, as may be seen by comparing a specimen of *Mantoida luteola* with the members of this group.

The Nemopteroides (*Eunemoptera*) or Nemopterid group occupies a position intermediate between the Neuroptera (Chrysopid group) and the Panorpid group. Such forms as *Nemoptera* are extremely Panorpid-like in the structure of the head, etc., but have retained other Neuropteron characters, thus making them annectent between the Neuroptera and Mecoptera, or Panorpids.

All of the groups described above (i. e., the Raphidian, Sialid, Chrysopid, Myrmeleonid and Mantispid groups) might be considered as suborders of the "Neuroptera" (used in the broad sense), but they are for the most part as different from each other as they are from the Panorpids, and if the Panorpids are to be regarded as a distinct order (the Mecoptera of authors), then these different groups of Neuropteroid insects should also be regarded as distinct orders.

The Panorpoides (*Mecoptera*) or Panorpid group is composed of two distinct subdivisions represented by such forms as *Merope, Panorpa,* and *Bittacus.* The Meropoides (*Promecoptera*), or Meropid group, differs so much from the others (i. e,, the mouthparts are not drawn out into a beak; the terminal abdominal appendages, wing venation, etc., differ markedly from the other Panorpids) that it might possibly be considered as a distinct order, although I would regard it as a sub-order, until more is known of the other representatives of the Mecoptera. The *Bittacus* group is quite distinct from the *Panorpa* group, but the differences are apparently those between groups of a family rank, rather than between suborders. *Merope tuber* is one of the most interesting members of the Panorpid group, and exhibits certain characters (terminal abdominal appendages of the male, etc.) suggestive of the ancestral condition of the Diptera and other

higher forms. I have captured in North Carolina some insects related to the Meropid subdivision, which suggest affinities with the Hymenoptera, but this can be determined only after a more thorough comparative anatomical study of the groups in question. The Mecoptera are related to the Chrysopid-Mantispid group, and also to the Nemopterid group. They also approach the Trichopteron line of development, and have retained certain features suggestive of the ancestral Diptera, so that the more detailed study of these forms should be of considerable interest from the phylogenetic standpoint.

The Phryganoides (*Trichoptera*) or Phryganid group is related to the Panorpid group, and also to the Neuroptera. The Trichopteron line of descent likewise parallels that of the Lepidoptera very closely, and the group furnishes us with many clues as to what the ancestral condition of the Lepidopteron line of descent must have been like. The Diptera also resemble the Trichoptera in some respects, and the Homoptera resemble them rather remotely. The closest affinities of the Trichoptera, however, are with the Panorpid and Mantispid-Chrysopid group, and with the Lepidopteron group in particular.

The Psocoides (*Clinoptera*) or Psocid group is an extremely interesting one, and the question of its relationship is still a matter of dispute. As far as the winged forms are concerned, they are undoubtedly near the Neuroptera, and exhibit certain characters strongly suggestive of affinities with the Homoptera (which are themselves related to the Neuroptera). Some of the features retained by the Psocid group are strongly suggestive of affinities with the Blattid-Perlid group also, and they may possibly be considered as occupying a position somewhat intermediate between the Blattid-Perlid group and the Neuroptera, although the closest affinities of the winged forms are with the Neuroptera, and they are undoubtedly very near the group which gave rise to the lines of descent of the Homoptera. The Hymenoptera resemble them in certain respects, but I have not been able to determine the meaning of this as yet, unless the Hymenoptera are also to be regarded as occupying a position intermediate between the Blattid-Perlid group and the Neuropteron-Panorpid group.

The "Hemipteroid" insects, or those usually designated as the "Hemiptera," form a rather heterogeneous collection of insects, which arose from ancestors somewhat intermediate between the Neuroptera and the Psocid line of development. They should be divided into at least two orders (possibly more) known as the Hemiptera proper and the Homoptera. The principal subdivisions of these groups are as follows:

The four most primitive lines of descent of the Homopterous forms are those of the Fulgorids, Cicadids, Psyllids and Aphids. The Fulgoroides (*Neurohomoptera*) or Fulgorid group is an exceedingly primitive one, and is closely related to the Neuroptera, such Fulgoroid forms as *Pochazia* (Ricaniinae) having retained certain features strongly suggestive of a Neuropteron ancestry. The Fulgorid group is also related to the Trichoptera and Lepidoptera (and somewhat distantly to the Panorpids), but they are much more closely related to the Neuroptera.

The Cicadoides (*Euhomoptera*) or Cicadid group, is closely related to the Fulgorid group, and has also retained certain characters which show a relationship with the Ascalaphids and Chrysopid group. Together with the Fulgorid group, the Cicadoid forms are among the lowest of the Homoptera.

The Psylloides (*Mesohomoptera*) or Psyllid group is quite closely related to the Cicadid group, as far as I am able to judge from the material available. They are also apparently related to the Coccid group, but this can be determined only after a more thorough study of intermediate forms.

The Aphidoides (*Clinohomoptera*) or Aphid group is related to both the Fulgorid and Cicadid group as well as to the Psyllids, etc. Their line of descent apparently arose from forms intermediate between the Neuroptera and Clinoptera (Psocids), and they have retained many features suggestive of the Psocids (Clinoptera) in particular.

The Aleurodoides (*Coniohomoptera*) or Aleurodid group is closely related to the Fulgorid group. These insects have retained certain characters suggestive of affinities with the Coniopterygidae (Neuroptera), which is to be expected, since

the Aleurodids are related to the Fulgorids, which in turn are closely related to the Neuropteron group, of which the Coniopterygidae are members.

The Coccidoides (*Microhomoptera*) or Coccid group, is rather closely related to the Psyllid group, in its general features, and is also related to the Aphids. A further study of intermediate forms is necessary in order to determine its closest affinities.

The preceding groups of Homopteroid insects might be regarded as sub-orders of the order Homoptera. I would consider that the Fulgorid, Coccid and Aphid groups are sufficiently distinct to be regarded as orders, however, but this is largely a matter of personal opinion.

The *Hemiptera* proper (sometimes referred to as the Heteroptera) are as closely related to the Homoptera as to any other insects; but, aside from the similarity in structure of the mouth parts, they have much less in common than is ordinarily supposed, and the Hemiptera proper should undoubtedly be considered as an order distinct from the Homoptera. Four typical groups or sub-orders of the Hemiptera proper are the Notonectid (*Euhemiptera*) and the Capsid groups (*Mesohemiptera*), which are among the more primitive of the Hemiptera and the Pentatomid (*Metahemiptera*) and the Berytid groups (*Apohemiptera*), which are more highly specialized. There are other groups which might be regarded as sub-orders, but the above mentioned ones will serve to illustrate the principal subdivisions of the Hemiptera proper. The true Hemiptera are so highly specialized that they are of no great interest from the standpoint of the study of phylogeny; but the Homoptera give some valuable hints as to the relationships of certain of the higher forms.

The *Lepidoptera* arose from ancestors whose lines of development occupied a position intermediate between the Chrysopid-Myrmeleonid group, and the Phryganid-Panorpid group. The line of development of the Lepidoptera also approaches that of the Homoptera in many respects. Some of the main subdivisions of the Lepidoptera are as follows: The

Micropterygid group (*Tricholepidoptera*) is extremely primitive, and might possibly be regarded as a separate order, but it is preferable to give it the rank of a suborder. This group is closely related to the Neuroptera and also to the Trichoptera. The Tineid group (true *Microlepidoptera*) is closely related to the Micropterygid group, the two together constituting the more primitive lines of descent of the Lepidopterous insects. Of the higher groups, the Pyralid group (*Mesolepidoptera*) is somewhat intermediate between the lower forms and the Hesperiid group whose line of descent closely parallels that of the Papilionid group (*Eulepidoptera*).

The ancestors of the Diptera arose from forms occupying a position intermediate between the Meropid group and the Nemopterid group, which is closely related to the Neuroptera, so that the Dipteron line of descent, if traced further back, ultimately approaches that of the Neuropterous forms. The line of descent of the Diptera also approaches that of the Homopterous insects, but the relationship is not a very close one. Of the lower Dipterous forms, the Psychodid group and the Tipulid group (*Prodiptera*) have retained certain characters suggestive of the Neuroptera, Trichoptera and Meropid group. The Leptid group (*Mesodiptera*) is related to both the Tipulid group and the Muscid group (*Eudiptera*). The Hippoboscid group (*Metadiptera*) has become markedly different from the remainder of the Diptera, while the Nycteribiid group (*Apodiptera*) has become so greatly modified, that it might be considered as a distinct order. The Braulid group (*Paradiptera*) has departed sufficiently far from the main Dipteron stem to be considered as a distinct order, since these insects have lost the halteres in addition to the wings, eyes, ocelli, etc., and the tarsi and other parts have become profoundly modified, so that they would scarcely be recognized as Dipteroid forms, did we not know their mode of reproduction, etc. The Phorid group (*Siphonodiptera*) serves to connect the Diptera with the Siphonaptera (Pulicid group), although it has not departed markedly enough from the Dipteron stem to be considered as a separate order.

The *Siphonaptera,* or Pulicid group, forms a rather homogeneous order of insects, which has been considered as a suborder of the Diptera, by many investigators. They have become sufficiently modified from the Dipteron type, however, to be considered as representing a distinct order, although their affinities are clearly with the Diptera, especially with the Phorid group, which evidently resembles the ancestral group which gave rise to the Siphonaptera.

The Hymenopterous insects should be divided into two orders, the *Prohymenoptera* or Tenthredinid group, and the *Hymenoptera* proper. The lines of descent of the Hymenopteroid forms are rather difficult to trace, and until more material consisting of very primitive or annectent forms, is available, it will be very difficult to determine with any degree of certainty, or satisfaction, the closest affinities of these insects.

On page 347, of the Ent. News, Vol. 26, 1915, I made the following statement: "The Hymenoptera very probably arose from ancestors not very unlike those of the Isoptera and Grylloblattids . . . this point, however, can be decided only after a more extended study of the Hymenoptera, and an examination of intermediate forms not at present accessible." A further examination of the primitive Hymenopteroid insects (Lydidae, Xyelidae, etc.) has indicated that these forms bear a strong resemblance to the Psocids, and certain features in them suggest a relation to both the Meropid-Neuropteron line of descent and the Blattid-Perlid line (to which the Isoptera, etc., belong). The resemblance to the Meropid-Neuropteron line is especially noticeable when the lower Hymenopteroid forms are compared with certain Meropid insects, which I captured in North Carolina, but have been unable to identify. This resemblance to both the Blattid-Perlid group and to the Meropid-Neuropteron group is a rather puzzling feature, but may possibly be explained by the fact that the Psocids, to which the Hymenoptera are related, also occupy a position intermediate between the Blattid-Perlid group and the Neuroptera, so that the Hymenoptera might also be regarded as somewhat intermediate between the two groups in question, al-

though their closest affinities can be determined only after the examination of annectent forms not at present accessible.

The Hymenoptera are considered by some investigators, as quite near to the Coleoptera, but I am not ready to accept this view at present. The fact that both have a complete metamorphosis has no particular bearing on their relationships, since in the Coccid group alone, the males may have a complete metamorphosis, while the females have not; so that this is of no great importance from the standpoint of the determining of the relationships of the different groups.

The Coleopteron line appears to lead back to the Perlids and closely parallels that of the Embiids and Dermaptera, and unless it can be shown that the same is true of the Hymenoptera, the relationship between the Hymenoptera and Coleoptera must be considered as very distant. Whether the differences between the less modified Coleoptera and the Curculionid group (*Paracoleoptera*) are sufficiently great to be considered as of the value of an order, is largely a matter of personal opinion. I would regard the Curculionids as one of the suborders of the Coleoptera, however, while the Platypsyllid group (*Apocoleoptera*), on the other hand, has become sufficiently modified to merit the rank of a distinct order.

As far as the other higher, or more modified orders are concerned, it is practically impossible to determine their closer affinities until more material of an annectent nature is available. I would venture the opinion, however, that the Thysanoptera will be found to be related to the Psocid group, and that the Strepsiptera will be found to be related to one of the lines of descent leading from the Neuropterous forms, rather than to the Coleopteron line—as has been hinted at by Pierce (Monograph of the Strepsiptera)—but whether they will prove to be near the Heteroptera or to some other group remains to be seen, and any opinion unsubstantiated by a study of very primitive or annectent forms belongs to the realm of pure speculation.

As may be seen from the foregoing discussion, it is possible to divide all winged insects into five (or fewer) sections, on

the basis of the closeness of their lines of descent. These are as follows: 1. The section *Palaeopteradelphia,* or Palaeopteron (Blattid) brotherhood, comprising the Blattids (and possibly the Mantids also.) 2. The section *Plecopteradelphia,* or Plecopteron brotherhood, comprising the Plecoptera and those insects whose lines of descent parallel that of the Plecoptera (e. g., the Embiids, Forficulids, Grylloblattids, Coleoptera, Termites, Gryllids, Tettigonids, Locustids, Phasmids, Phylliids, etc.). 3. The section *Neuropteradelphia,* or Neuropteron brotherhood, comprising all of those forms descended from ancestors similar to those of the Neuroptera (e. g., the Neuropteroid insects, Homopteroid forms, Hemiptera, Lepidoptera, Diptera, etc.). 4. The *Zygopteradelphia,* or Zygopteron brotherhood, comprising a small aberrant group (Anisoptera, Zygoptera, etc.), which may possibly be included in one of the other sections. 5. The *Plectopteradelphia,* or Plectopteron brotherhood, comprising the very primitive though strongly aberrant Ephemerid group. These five sections represent five evolutionary groups, although some of them might possibly be included in certain of the other groups, thus reducing the number; but I think that each of the five is distinct enough to merit being regarded as a separate line of evolution.

The section *Plecopteradelphia* (Plecopteron brotherhood) and the section *Neuropteradelphia* (Neuropteron brotherhood) comprise the greater part of all winged insects, and are thus by far the most important of the evolutionary lines. Whether the *Plectopteradelphia* (Ephemerid brotherhood) and *Zygopteradelphia* are sufficiently distinct from each other and from the Plecopteron group, to be considered as separate sections is open to question; and the fact that the *Palaeopteradelphia* (Blattid brotherhood) is closely related to the Plecopteron group also raises the question of its being sufficiently distinct to be regarded as a separate section. It must be borne in mind, however, that all of the sections are ultimately closely related, and the Plecopteron group itself is closely related to the Neuropteron group, but both appear to represent definite foci about which numerous other forms cluster; and the other

sections seem almost as distinct as these two, so that temporarily, at least, I would regard all five sections as representing distinct limbs of the developmental tree, two of which exceed the others in size and importance.

Among the Apterygotan forms there are but three sections —which also represent the main evolutionary lines of development in these insects. These sections are the *Proturadelphia* (or Proturan brotherhood) comprising such insects as the Eosentomidae, Acerentomidae, Neelidae, Sminthuridae, Achorutidae, Entomobryidae, etc.; the *Rhabduradelphia* (or Rhabduran brotherhood) comprising the Rhabdura, Dicellura, etc., and the *Thysanuradelphia* (or Thysanuran brotherhood) comprising such forms as the Lepismidae, Machilidae, etc., and about these three nuclei all of the wingless insects group themselves.

The Thysanuran line of development appears to approach as closely as any to that of the lower winged forms, but the retention of many of the characters found in certain wingless forms, by certain of the lower winged insects, makes it rather difficult to determine the exact relationships of the different lines of descent; and it is very probable that no one group of Apterygotan insects occupies the position of "mediary" between the wingless and winged forms, but the winged forms probably approach all of the Apterygotan groups to some extent, or arose from ancestors combining characters common to a number of Apterygotan groups, and therefore occupying a position somewhat intermediate between the groups in question.

The lines of development of the Crustacea (e. g., *Bathynella, Koonunga, Anaspides,* etc.) and "Myriopoda" (e. g., *Scolopendrella,* etc.) very closely parallel those of the lower insects, such as *Eosentomon, Anajapyx, Machilis,* etc., so that the Crustacea, "Myriopoda" and Insecta may be regarded as forming the three apices of a triangle, each apex of which is connected with the other two by mutual bonds of relationship. The lines of development of such Trilobites as *Triarthrus, Neolenus* and *Nathorstia* approach rather closely to the lines

of descent of the Crustacea, Insecta and "Myriopoda" (i. e., Diplopoda, Chilopoda and Symphyla) and are not far removed from the most primitive Crustacea, such as *Apus, Branchipus* and similar forms which approach the Annelida in many respects. The Merostomata, Arachnida, etc., on the other hand, have followed a course of development rather widely divergent from that of the Insecta, and are related to Insects only very distantly. The more detailed discussion of these Arthropodan lines of descent, however, is beyond the province of the present paper.

## A New Catagramma from Brazil (Lep.).

By Henry Skinner.

**Catagramma oberthüri** n. sp.

♂. Expanse 58 mm. Primaries blue, apices and margin black, base of wing in discoidal cell orange, extending from the base into the wing 14 mm. and for half this distance on the costa.

Secondaries blue black on inner two-thirds of the wing, outer third blue.

The underside in general is like the other forms of the *excelsior* group, except that the orange band is the same as above.

Described from two males from the Rio Madeira, Brazil, 8 deg. 45 min. South, 63 deg. 54 min. West. Academy of Natural Sciences of Philadelphia.

This species is related to *ockendeni* Oberthür and is named in appreciation of the splendid work on the genus in *Études Lepidopterologie Comparée,* Part XI, by Mr. Charles Oberthür.

### Photographs Received for the Album of the American Entomological Society.

During the year 1915 photographs for the Album were received and acknowledged from those whose names follow and the members of the Society wish again to thank the donors for their gifts which are much appreciated: R. A. Sell, William A. Riley, Walter Dannatt, George A. Chandler, J. F. Monell (from J. J. Davis), R. W. Braucher, Charles L. Heink, C. H. T. Townsend, E. D. Ball.

## Notes on Leptoypha mutica Say (Hemip.).

By Edgar L. Dickerson and Harry B. Weiss.

(Plate XVI)

In Banks' Catalogue of the Nearctic Hemiptera-Heteroptera is found the following reference to this species, "New Harm. 26, 1832; Compl. Writ. i, 349, 1859 (*Tingis*),—U. S." In Smith's *List of the Insects of New Jersey,* it is recorded by Barber from Madison as rare. Mr. H. M. Parshley states that he has no records of it from the New England States and Mr. H. G. Barber says that he has come across it only rarely in material which he has examined from the Southern States. Taking everything into consideration, it is evident that the species is not at all common.

An additional locality can now be listed from New Jersey, namely, Hammonton, where for the past few summers it has been extremely abundant on *Chionanthus virginica* L. growing in a nursery. These plants originally came from Norma, New Jersey, some years ago, but the bugs were noted by the writers only recently. In Stone's *Report of the Plants of Southern New Jersey* (N. J. State Mus. Rept. 1910), *Chionanthus virginica* is listed as occurring "only in low woods along the lower part of the Maurice River and Cohansey Creek and up the tributaries of the former to Buena Vista." Hough, in his *Handbook of the Trees of Northern United States and Canada* gives the natural range of this plant as along both sides of the Allegheny Mountains from southern Pennsylvania to southern Texas and states that it rarely attains a size greater than twenty-five or thirty feet and eight or ten inches in diameter. It is known by various common names among which are fringe tree, old-man's-beard tree, snow-flower tree, sunflower tree and flowering ash. While spoken of as a tree, it is really grown in the nurseries and sold as a bush most frequently, and is listed by the nurseryman as white fringe.

At Hammonton, the insects were abundant enough to injure practically every leaf on all the fringe bushes in the nursery. The injury first appears as a slight, whitish discoloration on the upper surface along the mid-rib, due to the abstraction of sap by the insect on the under surface. These

whitish patches gradually enlarge until the leaf has a mottled appearance and in severe infestations, the entire leaf becomes yellowish brown and withers completely. The under sides of the leaves also become covered with the brownish excrement of the nymphs and adults. Where the plants were growing in the sun, most of the insects were found on the under sides of the leaves, but in shaded situations and where the foliage was dense, many nymphs were found on the upper surfaces. After the second stage, the nymphs seem to migrate somewhat and feed singly and in colonies on any portion of a leaf which is shaded. No particular portion of a plant seems to be preferred as entire bushes were found infested from top to bottom.

On July 7, 1914, a few adults and all stages of the nymphs were found. On August 15, 1915, adults and nymphs were very abundant, and on September 1, 1915, adults and last stage nymphs only were present. It is quite possible that there are two generations each season and that the adults hibernate.

*Egg.* Length, 0.36 mm.; greatest width, 0.22 mm. The somewhat flask-shaped, smooth, whitish eggs were found on the under surface of the leaf, inserted as a rule in the mid-rib, but sometimes in the leaf tissue adjoining the mid-rib. Usually they occurred in small clusters, being stuck sometimes vertically in the tissue and at other times at an angle. The necks of the eggs seemed to be bent slightly so as to bring the caps on a level with the leaf surface. Where many eggs were found in a mid-rib, a distortion was present, the rib extending out on one side and being thickened at that point. The tissue surrounding the eggs was somewhat hard and corky and each egg-cap was topped by a brownish scab-like crust evidently deposited by the parent insect.

### Color Notes

*1st stage nymph.* Length 0.56 mm., greatest width 0.26 mm. (exclusive of tubercles.) Dorsal and ventral surfaces, light brownish red in general appearance. Abdomen posteriorly and medially tending toward brown; head, same brownish color. Antennae pale except at extreme bases. Coxa, trochanter and most of femur, brownish, remainder of legs, pale.

*2nd stage nymph.* Length 0.64 mm., greatest width 0.44 mm. (exclusive of tubercles). Ventral surface similar in color to that of the first stage; dorsal surface somewhat darker; antennae pale as in first stage except for the apical ends of the distal segments which are darker; head lighter medially; bases of legs darker than in first stage. Entire appearance of this stage is smoky brown with light ashen specks due to numerous secreting hairs from which hang clear drops of a somewhat sticky liquid.

*3rd stage nymph.* Length 0.92 mm., greatest width 0.62 mm. (exclusive of tubercles). Ventral surface darker and markings more pronounced except medially and laterally; dorsal surface brownish red; distal segment of antenna darker; legs darker; head lighter, eyes dark brown; ashen specked appearance more pronounced.

*4th stage nymph.* Length 1.28 mm., greatest width 0.86 mm. (exclusive of tubercles). Ventral surface slightly darker; legs, except tibiae, smoky brown; tibiae pale; antennae light brown except apex of penultimate and antepenultimate segments. Dorsal surface pale brownish red except medial parts of the abdomen, thorax and wing pads. Head pale brownish red. Specked, ashen appearance very pronounced.

*5th stage nymph.* Length 1.84 mm., greatest width 1.22 mm. (exclusive of tubercles). Similar to preceding stage except that the dark markings are more pronounced and the wing pads are dark at the anterior and posterior edges. Specked ashen appearance very pronounced.

*Adult* (from Vol. I, *Complete Writings of Thomas Say on the Entomology of North America,* edited by John L. Le Conte):

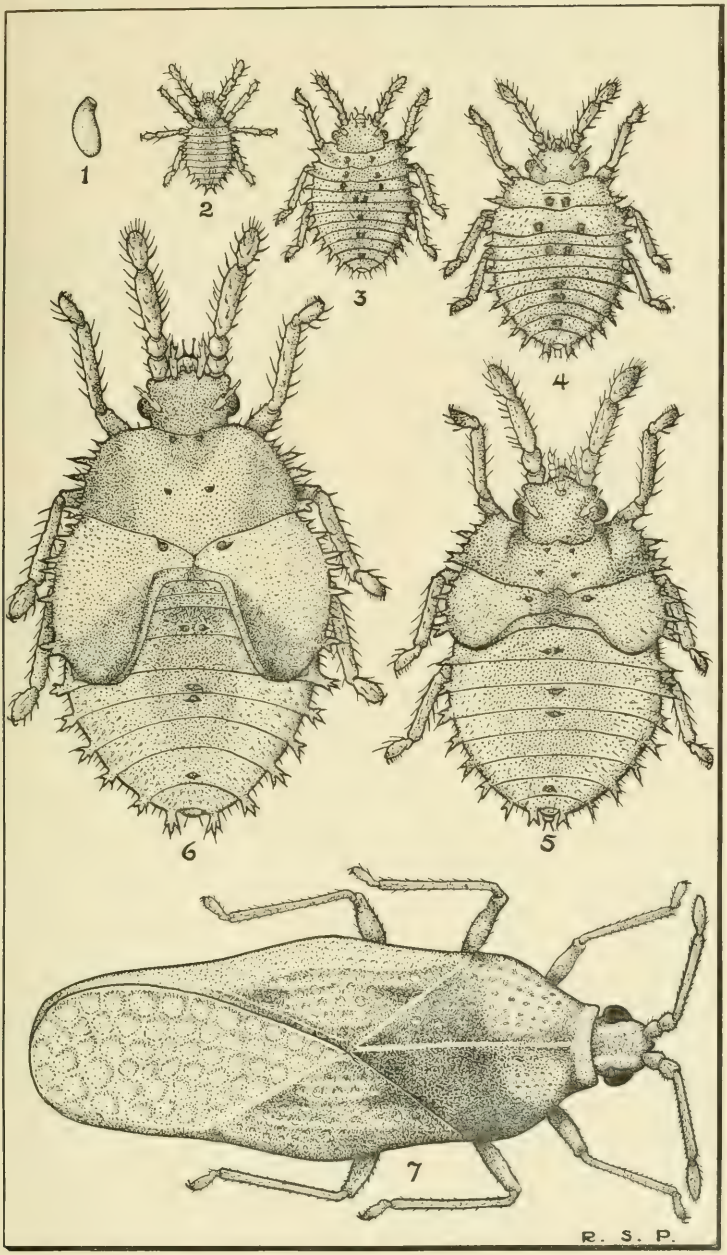
*Tingis mutica*—Thorax and scutel with a single line, hemelytra with a brown spot. Inhabits Indiana.

Body grayish brown, unarmed, not dilated on the margin; with much dilated punctures; antennae, second joint rather thicker than the first; thorax with a paler, slender, glabrous line and paler line each side; scutel with a paler line on the middle and a short one each side, not elevated; hemelytra like the thorax with dilated approximate punctures; on the middle an obvious darker, irregular spot or band; membrane reticulate with brown; beneath dusky, tibiae paler. Length to tip of hemelytra over one tenth of an inch.

## Explanation of Plate XVI.

(R. S. Patterson del.)

Fig. 1, egg.
Fig. 2, first stage nymph.
Fig. 3, second stage nymph.
Fig. 4, third stage nymph.
Fig. 5, fourth stage nymph.
Fig. 6, fifth stage nymph.
Fig. 7, adult.




LEPTOYPHA MUTICA—DICKERSON AND WEISS.

## A New Killing Bottle.

By Wm. Moore, Asst. Prof. of Entomology, University Farm, University of Minnesota.

In Bulletin No. 167 of the United States Department of Agriculture, mention is made of the feasibility of using paradichlorobenzene as a substitute for potassium cyanide in killing bottles. Being interested in the benzene derivatives and having a number on hand, killing bottles made of various derivatives of benzene were tried out. They all proved of value, but paradichlorobenzene being a solid gave the best results.

By placing a few pieces of paradichlorobenzene in the bottom of the desired bottle and heating to 55 deg. C. either over a flame or by dipping in hot water the paradichlorobenzene is melted. The bottle, without being corked, is then carefully placed in a cool place or in cold water until the paradichlorobenzene has solidified. Crystals are often found on the sides if the cooling is rapid, but these can easily be removed with a cloth.

The advantages of a paradichlorobenzene killing bottle over potassium cyanide are: First, the ease with which it can be made; second, the fact that paradichlorobenzene will not absorb water and thus spoil the bottle and specimens; third, the paradichlorobenzene bottle is full strength as soon as made and remains full strength as long as there is any of the material in the bottle; fourth, the bottle can be easily remade by putting in fresh paradichlorobenzene and melting,—fifth, paradichlorobenzene is not very poisonous to higher animals and great care does not have to be taken to clean up all the small pieces if a bottle is broken. This is of particular value where the bottles are used by students.

The disadvantage is the fact that if the bottle becomes warm and is then cooled that crystals are apt to be formed on the sides of the bottle or even on the specimens. Those on the bottle can easily be removed by a cloth, while the crystals on the specimens will soon evaporate without injury to the specimen when it is removed to the air.

A strong cyanide bottle freshly prepared with potassium cyanide and plaster of paris was used in comparison with a paradichlorobenzene bottle. In the cyanide bottle a honey bee was rendered inactive in three-quarters of a minute, a house fly one-half minute, a cockroach (*P. germanica*) one minute, a carabid two minutes and *Trombidium* sp. two minutes. In the paradichlorobenzene bottle the honey bee required four minutes, house fly two and one-half minutes, a cockroach (*P. germanica*) ten minutes, a carabid ten minutes and a *Trombidium* sp. five minutes. This time was for the cessation of all violent motions since slight movements of the legs or antennae were noticed for a much longer period of time. Probably the greatest value of the paradichlorobenzene bottle will be for students' use, because of its non-poisonous nature, but they should be warned that large insects such as beetles should not be collected in the same bottle, as delicate flies and moths, as the slow action of paradichlorobenzene would allow the larger insects time to injure the delicate specimens.

Paradichlorobenzene may be used as a substitute for naphthalene in insect boxes. A hot pin can be run into a lump of paradichlorobenzene as easily as into a moth ball and the box will be better protected than with naphthalene, as paradichlorobenzene will even kill the pests already present in the box.

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**An Efficacious Endoparasite of Chrysomphalus dictyospermi Morg. (Hym., Hom.).**

For some years past the Reale Stazione di Entomologia Agraria in Florence has been seeking a natural means of combating this scale insect. A valuable check on the ravages of the coccid has been sent from Madeira by Prof. C. P. Lounsbury and has been described as *Prospaltella lounsburyi* by A. Berlese and G. Paoli (*Redia*, xi, 305-307, Feb. 24, 1916). This Chalcid fly attacks not only the adult *Chrysomphalus* but also the male and female larvae. The parasitized female larvae are of a more intense yellow color and have a thicker cuticle than the normal individuals, while on the other hand the adult females are almost transparent and colorless and their cuticle is particularly fragile. The percentage of parasitized females in the material examined was estimated at 60 per cent. for the larvae and 40 per cent. for the adults. *P. lounsburyi* is 470 microns in length.

# On Certain Acanthagrions, Including Three New Species (Odonata).

By E. B. Williamson, Bluffton, Indiana.

(Plate XVII)

This paper is a brief account of material collected in Guatemala, British Guiana and Trinidad by B. J. Rainey, L. A. Williamson and myself. At Tumatumari, British Guiana, we were aided by Mr. A. F. Porter and Mr. J. M. Geddes; and in Trinidad we enjoyed the frequent companionship of Mr. F. W. Urich and Mr. P. L. Guppy.

*Pruinescence.* It is a matter of common observation that in many agrionines pruinescence appears first on the under parts of the thorax. Pruinescence in certain calopterygines is known to be displayed by the male and it is possible that pruinescence in agrionines may serve a similar purpose. In *Acanthagrion* there are between the first coxae, and probably also between the second coxae, bright shining black areas which, in the case of the first coxae at least, are not covered with pruinescence. These black areas in their white field might be displayed by the male fluttering over the female. However the female is about as definitely marked as the male and the theory of sexual display seems rather improbable unless the female uses the same parts to advertise her sexual maturity. I have not examined species in other genera to see how common this type of ventral coloration is. It may also be noticed in this connection that the lower posterior angle of the thorax is tipped with black and there is a more or less definite dark longitudinal mid-ventral line on the first abdominal segment. These various marks produce a definite and uniform ventral color pattern, the most plausible value of which would seem to have to do with the relation of the sexes.

*The Penis.* In his study of the penis of Zygoptera Mr. Kennedy has given systematic odonatology a new and valuable tool. Specimens from Trinidad appeared, when judged by conventional characters, to be scarcely distinct from *gracile.* However, there were enough differences to excite suspicion, and when specimens were given to Mr. Kennedy for study,

to our great surprise, he found that the penis of these Trinidad specimens was entirely distinct from that of *gracile*. It is therefore very appropriate that this Trinidad species, the positive recognition of which has been possible only through Mr. Kennedy's work, should be named *Acanthagrion kennedii*.

*The mesepisternal fossae.* In Plate XVII, figures 10, 11, 12 and 13, I have figured a portion of the right dorsum of the thorax of four females. In these four species there is, on either side of the middorsal carina, and immediately adjacent thereto, and at varying heights on the thorax, a small more or less semicircular depression which, in these species at least, functions as a socket for the reception of half of the posterior dorsal termination of the tenth segment of the male. These depressions have the middorsal carina between them variously modified. As shown by the figures, and as might be expected, the fossae are placed higher on the mesepisterna in *gracile* than in *kennedii* and still higher in *ascendens*. The name, mesepisternal fossae, given to these pits or depressions, has been suggested by Dr. Calvert.

**Acanthagrion kennedii** n. sp. (Plate XVII, figs. 5, 6, 8, 11).

Abdomen ♂ 24-27, average 25.5, ♀ 24-25; hind wing ♂, 15.5-17.5, average 16.6, ♀ 17-18.

♂.—Genae, labrum and rhinarium green, the rhinarium usually duller than the labrum, and the labrum with an impressed posterior median spot and posterior lateral margins dark brown or black. Nasus black, the extreme posterior lateral corner green. Frons in front with a large quadrangular, slightly oblique bar on either side, varying in color from green to obscure green, yellowish or brownish, and varying also in size, in rare cases reduced and so obscured as to be scarcely evident. Head above black; postocular spots greenish blue rounded, with very little variation in size, about equal to a circle enclosing the ocelli. Rear of head above level of foramen black; below pale, dull or yellowish or greenish tinged.

Front lobe of prothorax pale or yellowish, with a black posterior spot on either side and with the anterior border more or less black; middle lobe black with a variably-sized yellow spot on either side near the lateral margin, this spot never large, reduced to a mere point in many cases, and sometimes wanting; hind lobe black, a small yellowish spot at either extreme end, this spot almost directly posterior to the spot on the middle lobe when the latter is present. Propleuron largely yellowish or greenish, black above.

Dorsum of thorax black, a pale yellow or yellowish blue antehumeral stripe, expanded above at the antealar sinus, then gradually constricted to about one-half the maximum width above, then gradually widening till, at its extreme lower end at the end of the sclerite, it is about three times its width at the narrowest place above; the stripe slightly variable in width in different individuals. A black humeral stripe, wider than one-half the dorsal black, occupying much of the mesepimeron and extended across the mesinfraepisternum, leaving only the lower posterior border of the latter pale; this humeral stripe above notched with pale on its posterior border, and joined along the wing base with a more or less distinct short black spur on the first lateral suture; sometimes this short spur is joined to the humeral suture also across the pale notch in the latter, in which case a pale isolated spot is enclosed. Remainder of sides of thorax pale yellowish or greenish, a black spot above on the second lateral suture which is usually produced as a narrow, sometimes indistinct, stripe on the metepisternum along the second lateral suture, in its maximum development scarcely reaching the level of the mesostigma. A more or less distinct broad greenish or bluish band across the metepimeron parallel and adjacent to the second lateral suture, the posterior triangular area thus marked off being more heavily pigmented and more distinctly yellow than the area anterior to it. Beneath flesh-colored.

Abdomen above black, 1 with apical integument blue; black on 2 more or less narrowed subbasally, at the extreme base expanded laterally as a mere line, widened subapically over an extensive rounded area, in general about as wide as the pale sides and as the black on 1; 3-7 with narrow basal pale rings or spots; 7 apically blue beyond the row of spines in every case and in many cases an equal area basal to the spines also blue; 8-9 blue; 10 black. Sides of 1 and 2 with lower two-thirds greenish, posterior border of 1 black; base of 3 greenish, fading out posteriorly into yellowish which reaches about mid-height, expanded basally to form the basal ring, and constricted apically by the expanded dorsal black which, at the extreme apex, reaches the lower edge; 4-7 similar but yellowish, with little or no bluish or greenish, at the base of each, and with the paler lateral area progressively narrowed by the widened dorsal black which reaches a maximum on 7; 8-9 blue; 10 black, beneath yellowish brown. Appendages black, inferiors yellowish brown at base.

Legs yellowish brown, femora black on the superior surface, increasing apically where the black surrounds the femur, more extensive and intense in some individuals than in others but in all darkest on the first femora and palest on the last; first tibiae, and second more or less, black-lined on anterior face, the line tending to break into a series of connected spots; tarsi varying from brown, with apices of joints dark, to largely dark; tooth on tarsal claw similar to *gracile*.

Wings hyaline to slightly brown tinged; stigma black, shorter than I have seen in *gracile*.

♀.—Labrum yellowish brown, darker at base, shading out insensibly to the pale lower border. Genae, rhinarium and frons in front olive, the two latter the darker, the frons sometimes dark reddish brown. Nasus black, one specimen with an obscure spot on either side. Frons in front with the pale areas, as compared with the male, generally greatly more extended with the result that in some cases the black is reduced to a longitudinal median stripe, wider above and below. Head above as in the male with the postocular spots more bluish; in some cases there is on either side a small round brown spot just behind and external to the antenna, and indistinct areas of the same color in front of the median ocellus.

Prothorax similar to male, but pale color bluish.

Thoracic pattern similar to male, but pale blue replacing the yellowish colors of the latter, except in the posterior triangular area of the metepimeron which is more or less distinctly yellowish. Metepisternum from the wings to slightly below the level of the stigma is a darker blue than the color which bounds it on both sides and below (in the male the corresponding area is more or less slightly more green than the surrounding areas).

Abdominal segments 1-7 similar to male; 8 black (pale basally on either side in one case), apex pale beyond the spines (and in one case for a distance anterior to the spines equal to about one-half the part posterior to the spines); 9 with apical half or two-thirds blue, this blue encroaching on the black in a large quadrangular median spot which reaches the base of the segment or is separated therefrom by a narrow transverse line of black; 10 blue. Seen from the side similar to the male but with blue or bluish replacing green; 8 in one specimen with a blue basal spot as described in dorsal view, in others black, the narrow inferior yellowish margin slightly widened basally; 9 with the blue appearing as a large distal superior triangular spot, the base of the triangle on the apical border of the segment, extreme lower margin of segment yellowish; 10 blue, lower half paler and duller. Appendages black. Vulvar spine large, black tipped.

Legs as in male, but black greatly reduced especially on parts distal to the femora.

Wings as in male, but stigma light brown.

Trinidad, 1912: Cunapo River, Feb. 27, 10 ♂, 1 ♀; Arima, March 4, 15 ♂, 1 ♀; Cumuto, March 6, 8 and 10, 88 ♂, 8 ♀; *types* a ♂ and ♀, Cumuto, Trinidad, March 10, 1912, in the writer's collection. Named for Mr. Clarence Hamilton Kennedy in recognition of his work on Zygoptera penes which has made the recognition of this species possible.

Males of this species were sent to Dr. Calvert and Dr. Ris. Dr. Ris writes, "It is almost exactly similar to a few Acanthagrions taken by myself in Bahia in 1890; I have considered them nearly typical *gracile*." Dr. Calvert says, "It is nearer *gracile minarum* than no. 2 (*indefensum*) is. I am inclined to so consider it; almost the only objection is the presence of black stripe on second lateral thoracic suture." In view of these opinions any comment on the difficulty of recognizing this species is superfluous.

In Calvert's key to the males of *Acanthagrion* of the *gracile* group (Od. Neotrop. Reg., Ann. Carnegie Mus., Vol. VI, pp. 161-2) *kennedii* will run out to *gracile* or *g. minarum*. *Minarum* was described by de Selys from material from Minas Geraes. It is possible it may prove to be specifically distinct from *gracile,* but there is no reason to think it is the same as the species here described from Trinidad. *Vidua* de Selys, from Venezuela, might possibly be expected in Trinidad, but it is not represented in the material before me unless *ascendens* should turn out to be a synonym, which I think is improbable.

Compared with material from Guatemala determined by Calvert as *gracile,** males of *kennedii* differ in the blue color of the head, thorax and basal abdominal segments of *gracile* being replaced by green and yellowish, thus approaching *ascendens*. A comparison of the descriptions will show that black is more extensive on the head and thorax of *kennedii* than of *gracile*. In posterior views of the male appendages, the superior appendages of *gracile* are seen to be longer (higher) with the superior rounded angle reaching well above the constriction in the dorsal elevation of segment 10; in *kennedii* the appendages reach this constriction but do not extend above

[*Since this paper was written, a study of the penes of specimens in the Cornell and Harvard collections has brought to light two more species included under the name *gracile*. As both are from Brazil it may be that one or the other of these will be found to agree with the type of *gracile* in the Selys collection. Neither of these Brazilian species are described or figured in Mr. Williamson's article or in my own in this number of the NEWS.—C. H. KENNEDY.]

it. Venational differences may be noted in the tabulation which closes this paper, especially the more apical position of the arculus and of vein A and the larger number of post-nodals in *kennedii.*

Like *ascendens* (see *posteà* under that species) the female of *kennedii* runs out to C, under B, under A. As might be expected the mesepisternal fossae of *kennedii,* corresponding to the shorter (lower) appendages and the less elevated tenth segment of the male, are placed lower on the sclerites than in *gracile.* It is possible the form of the mesostigmal lamina may be of value in separating the two species. As in the male, the female of *kennedii* has much more black than the female of *gracile;* for example *gracile* has the nasus largely pale and the dorsum of the head more extensively pale-marked, and the dark markings on both thorax and legs are reduced in extent as compared with *kennedii;* in *gracile* in some cases abdominal segment 8 in side view is largely pale, the black occupying the upper third of the segment for about two-thirds its length from the base; in those cases where the black is more extensive and reaches the apex of the segment the inferior yellowish border is fully twice as wide as it is ever found in *kennedii;* segment 9 is similarly conspicuously paler in *gracile* and even in the darkest examples the superior apical blue area posteriorly blends insensibly below into the pale inferior margin which is much wider than in *kennedii* where the posterior triangular blue spot is definitely separated by dark from the narrow inferior pale margin.

Fortunately we took a large number of this difficult species, and this material will be so distributed as to give students generally an opportunity to know the species from specimens as well as from my description. It is to be hoped for the sake of convenience that definite characters, in addition to those of the penis, may be detected. Much of this material was collected at the small swamp at Cumuto where we took three species of *Metaleptobasis,* a new *Telagrion,* and many other things (see *Notes on Neotropical Dragonflies,* Proc. U. S. Nat. Mus., Vol. 48, 1915, p. 601).

**Acanthagrion indefensum** n. sp. (Plate XVII, figs. 3, 4, 7).

Abdomen ♂ 23; hind wing ♂ 15-15.5.

♂.—Similar to *kennedii* and *gracile* but smaller; like *kennedii* as described except as noted below; one specimen with a large blue spot on either side between the apex of the second joint of the antenna and the eye, and a small obscure yellowish spot on either side just inside the first joint of the antenna, the blue postocular spots in this specimen much larger than in the other specimen where they are about the size of the spots in *kennedii,* and in both specimens the postocular spots are irregular lobate in outline as contrasted with the entire outline of *kennedii.* Rear of head above, about foramen, and below adjoining mouth parts, black, thus differing from both *gracile* and *kennedii* which are pale below.

Prothorax black, thus darker than in *kennedii*; front lobe with a median bright blue spot. Propleuron below dull or leaden blue.

Thoracic pattern similar to *kennedii* but clear blue replacing the yellow or yellowish-tinged parts of *kennedii,* in which character *indefensum* is like *gracile.* The black stripe along the second lateral thoracic suture is more definite and more intensely black than it ever attains in *gracile* and as it very rarely attains in *kennedii.*

Abdominal segment 1 variable; in one specimen the dorsal black, which is about as wide as in *kennedii,* fails to reach the apical integument by a distance equal to the length of this integument, that is, the black is a quadrate basal spot; in the other the black is narrowed apically, but reaches the blue integument, and there is a median blue spot which is contiguous posteriorly with the integument. Sides of 1 and 2 blue, instead of green or greenish, thus again resembling *gracile.* Remainder of abdomen like *kennedii* with apical integument only of 7 blue.

Legs much darker than in *gracile* or *kennedii*; first femora entirely black except the base on the inner surface; on the second femora the pale basal color on the inner surface not quite reaching the middle of the femora; the third femora still paler, with a pale line on the anterior dorsal surface, this pale line broader basally and disappearing before the apex where the femur is completely circled with black, the inner surface otherwise pale; first tibiae with anterior dorsal surface black; second and third tibiae black at base and apex; tarsi black, claws dark amber, darker than in related species, toothed as in *gracile.*

Wings hyaline; stigma black, similar in shape to *kennedii.*

Wismar, British Guiana, Feb. 16, 1912, two males in my collection.

One of the specimens was sent to Dr. Calvert who writes, "Most like *A. gracile minarum* of anything I know but ab-

dominal segment 10 not so elevated, superior appendages not so high, and an additional black stripe on the second lateral thoracic suture." Of the four related species of the *gracile* group considered in this paper, *indefensum* has the lowest tenth abdominal segment, and the superior apical apex is strikingly rounded as compared with the others. It will be interesting to know the female of *indefensum* and to note what modifications of the middorsal thoracic carina between the mesepisternal fossae have taken place. May it not be expected that here the carina will be indented rather than elevated as it is in *ascendens?* In spite of its close resemblance to *gracile,* I believe that this species offers no such difficulties as *kennedii,* since the appendages are strikingly different from its closer allies. These differences, however, are concerned with parts of inferior appendages which have received little attention. In many genera of Agrionines the inner posterior surface of the inferiors are variously modified, the most common form being a dorsally directed, acutely tipped, tubercle. These parts are concealed in lateral views, and are inconspicuous and usually neglected in dorsal views. In *kennedii* and *gracile* the inner face of each inferior appendage is produced in a great flattened, inward curved, obtuse tubercle; in *indefensum* this is reduced to a small inconspicuous prominence; the appearance in posterior view of the apex of the abdomen of *indefensum,* as compared with *gracile* and *kennedii,* has suggested the specific name (see figs. 7, 8 and 9, Plate XVII).

On February 16, my father and I collected near the canal and government sawmill at Christianburg about a mile below Wismar. A short distance above the sawmill a dressing room for bathers is located. We collected in brush on the right bank of the canal below this dressing room, and along a small stream on the left side of the canal, parallel to and only a short distance from it, in the brush. My notes fail to show just where the two specimens of *indefensum* were collected.

**Acanthagrion adustum** n. sp. (Plate XVII, figs. 1, 2, 10).

Abdomen ♂ 21-22.5, average 21.95, ♀ 21-22; hind wing ♂ 14-15, average 14.75, ♀ 16.

♂.—Genae light orange. Labrum light orange to dark orange or obscure reddish brown, narrowly black at base and on posterior lateral borders with a basal median black impressed spot. Rhinarium slightly darker than labrum. Nasus rarely entirely black, usually a median transverse orange bar, sometimes this larger with margins orange, except at base, thus reducing the black to a submarginal black ring. Frons in front light orange to obscure reddish brown, naso-frontal suture black, wider in the median line which is produced posteriorly in a more or less distinct narrow longitudinal black line which joins a distinct short transverse crescent-shaped black area of varying width lying in front of the median ocellus, and between the antennae from which it is separated by about its own length. Color of head above very variable in the extent of black; in the palest there is a short oblique black line on either side of the median ocellus and a median triangular black spot back of it; starting posterior to the lateral ocellus a suture-like line runs outward and forward to the eye which it meets on a level between the antenna and the median ocellus; anterior to this line all is slightly dull reddish orange with the restricted black markings above described, and posterior to this line the dorsum is solid black except for the large isolated postocular orange spots, and a narrow orange edging on the occiput. In darker specimens the ocelli are surrounded by black with a small orange spot in front of each lateral ocellus; from the black spot about the median ocellus a short bar runs outward and forward on either side toward, but not reaching, the antenna; the inner face of the second joint of the antenna is black, and posterior to this joint a short rounded bar runs toward, but does not meet, the eye; posteriorly from this bar, on a line with the antenna, there is a more or less distinct black connection with the large posterior black area. In the maximum development of black this becomes a wide black bar; the bar from the median ocellus reaches the antenna; midway it sends off an anterior branch which runs forward and inward to spread out and fuse with the black anterior to the median ocellus and the median transverse black bar on the frons; this above described anterior branch also near its middle throws off an anterior branch which runs outward and forward to the angle of the frons, then outward and backward across the first joint of the antenna to the inner face of the second joint. The orange or reddish brown postocular spots vary in size from as small as the area within the ocelli to fully twice this diameter when the lateral and posterior margining black is narrow, but in every case the spots are completely surrounded by black. Rear of head black, yellow margined against the eyes.

Prothorax with front lobe orange, more or less black posteriorly on either side; middle lobe black with a geminate median orange spot

of varying size and, on either side, an orange spot of varying size, in some cases large and conspicuous, and in some cases entirely wanting; the difference between extreme cases, as in the case of the head markings, is striking; hind lobe largely orange or this reduced to the extreme posterior edge and divided in the median line by black. Propleuron black above, yellow below, less variable than the median lobe.

Thorax above orange or reddish brown; on either side a straight black stripe, about two-fifths the width of the mesepisternum, separated by a pale median stripe starting at the antealar sinus and widening uniformly below, variable, scarcely more than a line in some cases and, in others, at about its mid length, almost half the width of the adjacent black stripes. A posthumeral stripe, slightly wider than the black stripe on the mesepisternum, entirely black in the brightest colored specimens, in others fading out along its posterior border, the black above and below being most persistent with the intermediate black reduced to the anterior line at some points; this posthumeral stripe continued across the mesinfraepisternum which is yellow in about its lower half. A black spot on the second lateral suture above, continued below in most cases as a black or brownish stripe lying on the anterior side of the suture, this stripe varying in width from the merest line to about one-half the width of the dorsal black stripe, and, in its extreme length, almost or quite reaching the metastigma. Metepisternum pale yellow and dull orange or orange brown in irregular pattern, in some cases the darker color is almost exclusively present, in others it is confined to the median and posterior portions of the sclerite. Metepimeron with a wide stripe of pale yellow parallel to the second lateral suture, the posterior triangular area dull orange. Metinfraepisternum pale dull yellow, narrowly black above. Beneath posterior to coxae dark colored or black, early becoming pruinose, orange brown adjoining the abdomen.

Abdomen above black, 1 and 2 usually with purplish reflections, the others with greenish reflections; apical integument of 1 pale blue; 3-8 with small basal, pale blue or green spots or rings; on 8 these spots are small, bright blue, and widely separated by the median black, not always present or, at least, not evident, in dried material; apical fourth to three-fifths of 8 and all of 9 bright blue, the blue on 8 indenting the black in the middorsal line in a more or less triangular area, the apex directed anteriorly; 10 black. Sides of abdomen pale, in the brightest-colored specimens bluish or greenish yellow on 1 and 2, and the base of 3, then yellow on 3-7, 8-10 bright blue; apical edge of 1-6 narrowly dark or black ringed; pale sides of 2-7 continuous with the basal rings or spots, apically on each segment the dorsal black widens and, with the apical black ring, separates the pale area

of one segment from the succeeding segment; seen from the side the blue and black of 8 are about of equal width, the black descending possibly a little more than half way, and there is a very narrow apical black ring; on 10 the dorsal black is extended narrowly on the sides of the segment at the base, reducing the blue to a large apical spot, beneath dull yellowish brown. Superior appendages black, sometimes brown on their posterior face, the apical inner angle with a minute acute spine; inferiors dark brown or black, pale at base and below.

Legs brown, coxae black-spotted in front at the base; femora dark on the superior face, increasing apically where the black surrounds the femur, the first femora the darkest, the last the palest, and varying in individuals; when reduced tending to break up basally (where it first disappears) into spots; tibiae with their anterior dorsal face black-lined, darkest on first tibiae, least developed on the last; tarsi black; tooth on tarsal claw as in *gracile,* possibly very slightly less developed.

Wings hyaline; stigma orange or reddish brown, conspicuous in color to the unaided eye.

♀.—Similar to the male, slightly duller and darker and with the black markings reduced. Genae lighter, light yellowish brown. Apparently as variable as the male in the color pattern of the head and thorax; the posthumeral black stripe noticeably more reduced than in the male, the upper and lower ends distinct but the intervening space represented by the merest black line or an indefinite row of disconnected obscure dark markings. On the metepimeron the distinction of pale yellow and dull orange is not so well marked.

Abdomen above black with greenish reflections, most marked on the proximal segments and completely disappearing on the distal segments; 3-6 with narrow basal rings or spots, slightly duller than in the male and with the pattern less definite; 7 with basal ring scarcely evident, and no trace on 8 of the basal blue spots often present in the male; extreme apex 7-9 blue; 10 blue except a small narrow triangular median black spot, the base of the triangle on the base of the segment. Sides similar to male; 8 with the entire lower edge narrowly yellowish; 9 apically at midheight with a large indefinite blue or yellowish area; 10 with the black on dorsum produced laterally narrowly along base, the sides bright blue, yellowish below; the restricted dorsal black results in 10 being much paler in the female than in the male, in contrast with 8 and 9 which are much darker in the female than in the male; appendages black. Vulvar spine large, black tipped.

Legs as in male. Wings hyaline; stigma pale brownish yellow.

Wismar, British Guiana, January 30, Feb. 15 and 16, 1912, 20 ♂, 2 ♀; *types* ♂, ♀, Feb. 15, in the writer's collection.

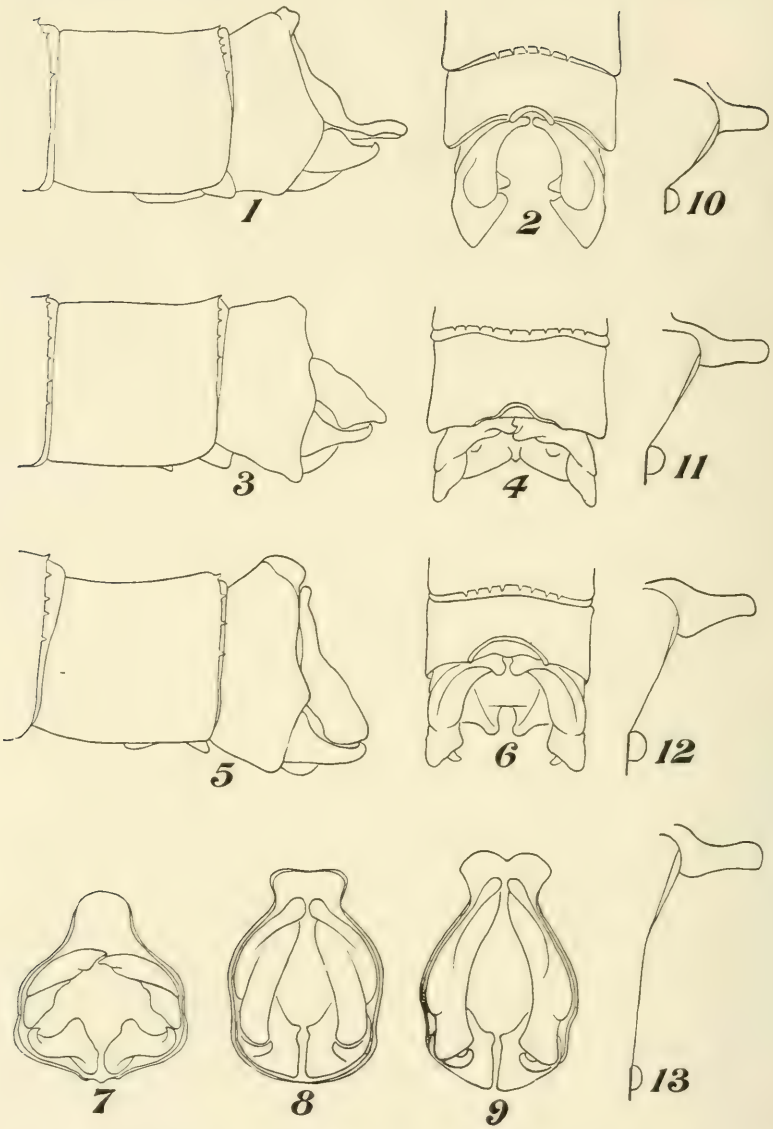
The specific name is suggested by the prevailing pale colors of the head and thorax giving the insect a brownish or sunburned appearance.

Males of this species were sent to Dr. Calvert and Dr. Ris. Dr. Calvert writes, "I do not know it." Dr. Ris says, "It is unknown to me and I cannot identify it with any of the described species; note its long feet and comparatively long spines." In Calvert's key to male *Acanthagrion* of the *gracile* group (Odonata Neotropical Region, Ann. Carnegie Museum), *adustum* might run out to C, p. 161, or CC, p. 162; if the latter, it is separated at once from *truncatum* by the form of appendages, the basal black of abdominal segment 8 of *adustum,* and many other characters, noting especially the yellow colors of *adustum.* If run out to C, p. 161, it would go in the key to HH, under which two varieties of *gracile* are distinguished; *adustum* is separated at once from these two by having the basal two-fifths to three-fourths of segment 8 black (blue in others) and by the yellow coloration of head and thorax of *adustum.* In de Selys' arrangement (Le Grand Genre Agrion, 1876), *adustum* properly belongs in his *première section,* though, so far as the origin of A with reference to the cubitoanal crossvein goes, some of the wings are as described in his *seconde section,* a section, however, recognizable by other characters; *adustum* belongs to the *gracile* group, under de Selys' *première section,* running out to *temporale,* from which species it is separated at once by the postocular spots not continuous with the rear pale color of the head (as in *temporale*) and by the extensive black on segment 8 in *adustum* (blue in *temporale*).

In Calvert's key to female *Acanthagrion* (loc. cit., p. 162), *adustum* might run out to B or BB; in either case it may be recognized by having abdominal segment 9 black, 10 largely blue, pale colors of head and thorax largely yellow or yellowish, not blue.

This species flew with *Enallagma*- or *Ischnura*-like flight in the vegetation bordering the canal along its left bank just above the sawmill at Christianburg, a mile below Wismar.

(To be continued)




ACANTHAGRION ADUSTUM, 1, 2, 10; A. INDEFENSUM, 3, 4, 7; A. KENNEDII, 5, 6, 8, 11; A. "GRACILE," 9, 12; A. ASCENDENS, 13.—WILLIAMSON.

EXPLANATION OF PLATE XVII.

Figs. 1, 2 and 10. *Acanthagrion adustum,* type ♂ and ♀, Wismar, British Guiana, Feb. 15, 1912. 1 and 2, appendages of ♂; 10, portion of right dorsum of thorax of ♀, showing the mesepisternal fossa and mesostigmal lamina.

Figs. 3, 4 and 7, appendages of ♂ of *Acanthagrion indefensum,* type, Wismar, British Guiana, Feb. 16, 1912; 7 posterior view.

Figs. 5, 6, 8 and 11. *Acanthagrion kennedii,* type ♂ and ♀, Cumuto, Trinidad, March 10, 1912. 5, 6 and 8 ♂, 8 posterior view; 11 ♀, same as 10.

Figs. 9 and 12. *Acanthagrion "gracile."* 9, posterior view of ♂, Morales, Guatemala, May 27, 1909; 12, same as 10, ♀, Gualan, Guatemala, June 10, 1909.

Fig. 13. *Acanthagrion ascendens.* Same as 10, ♀, Georgetown, British Guiana, January 27, 1912.

## Notes on the Penes of Zygoptera (Odonata).

### No. 1. Species Limits in the Genus Acanthagrion.

By CLARENCE HAMILTON KENNEDY, Cornell University.

(Plate XVIII)

In the fall of 1913, when I was working with the Argias and Ischnuras of Washington and Oregon[1] I discovered that the penis, hitherto overlooked by systematists who had studied the Zygoptera, was in some cases an excellent generic character and in other cases even a good specific differential. In the Fall of 1914, when I was working over my collection of California Odonata and found it expedient to describe two new genera,[2] I went into a careful study of the penis in these and related genera, which convinced me that the penis had characters worth studying and made me desirous of carrying the study further. This opportunity came in the Fall of 1915, when I had the privilege of spending several weeks studying with Mr. E. B. Williamson in his private collection and laboratory at Bluffton, Indiana. At this time I drew two

[1]Notes on The Life History and Ecology of the Dragonflies (Odonata) of Washington and Oregon, C. H. Kennedy. Proc. U. S. Nat. Mus., Vol. 49, pp. 259-345, 1915.

[2]Notes on The Life History and Ecology of The Dragonflies (Odonata) of Central California and Nevada. (In press.)

views each of the penis in over three hundred species of Zygoptera. Since my arrival at Cornell I have had the privilege of spending altogether two weeks studying the species of Zygoptera in the collections of the Academy of Natural Sciences of Philadelphia, and of Dr. P. P. Calvert through his courtesy. To date I have drawn the penes of over five hundred species of Zygoptera, having made altogether over one thousand figures, and am hoping to continue the work until the subject is completed, as a monograph.[3]

I wish here to thank Mr. Williamson and Dr. Calvert and Dr. Skinner of the Philadelphia Academy, who have so generously opened their collections to me, as it is only through such interest and generous assistance that this study has been made possible.

When this work was begun, I felt some assurance that the penis would be, not only a good generic, but also a good specific character. More extended study however has shown that only a monographic study of the penes in the entire group of Zygoptera will reveal just how far these organs can be trusted to show true relationships between species and groups, for it has already become evident that the value is very different in different groups.

The accompanying text figure is a diagram showing what seems to me to be the zygopterous penis stripped of its special modifications, in other words what might be its most generalized form. I have no evidence that this is also its most primitive form, as in those genera usually considered most primitive the penis may be most fantastic in the complex modifications of these simple parts, so that it appears that there has been a tendency to a reduction in its complexity from the more primitive forms to those more recent. However there are undoubted exceptions to this. The zygopterous penis

[3]On Jan. 1, 1916, Dr. Needham received a copy of Dr. Erich Schmidt's interesting paper on this same subject of penes (Vergleichende Morphologie des 2. und 3. Abdominal-segments bei männlichen Libellen. Zool. Jahrbüchern. Bd. 39, Heft, 1, 1915.) It was the first intimation I had had that some one else was working on the same subject. Dr. Schmidt has dealt with seventy species of Zygoptera.

which is an appendange of the ventral side of abdominal segment two consists usually of three segments and two, usually unchitinized folds. Segment 1 is the basal or proximal, slender, heavily chitinized shaft. Segment 2 is the moderately chitinized median segment, while segment 3 is the apical or distal segment which folds forward on the median segment and is usually unchitinized. The median segment ordinarily carries across its ventral surface a fleshy ridge or fold, the inner fold, and across its posterior end the terminal fold. This latter is probably erectile in many species. Either or both fleshy folds may be lacking and in the Legion Lestes segment 3 is much reduced. The differences between penes are usually in the shape of the distal or third segment.

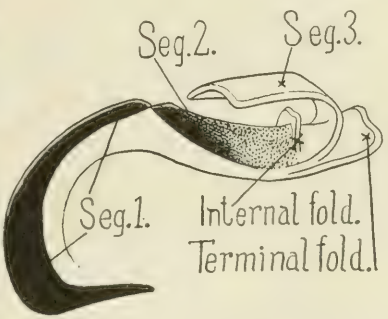


Diagram showing the parts usually found in the zygopterous penis.

I have introduced this present series of papers with this one on *Acanthagrion* to have it appear in conjunction with a paper on some species of the same genus by Mr. Williamson.

The study of the penes in this group at once cleared up the hitherto obscure relations of the various forms which had variously been termed varieties and subspecies. Those that have been studied are, as far as the penis is concerned, good species. Mr. Williamson and I were both much surprised when we found the great structural differences existing in the penes of the so-called "subspecies" (*ablutum, ascendens, minarum*[4]), of *gracile*. The penes of the thirteen species of *Acanthagrion* I have been able to examine vary more among themselves in form than those of any similar group of closely related species of Zygoptera. If I had seen the penes only, I

[4]The *minarum* referred to by Mr. Kennedy is the species described by me (*anteá*, p. 314) as *kennedii*. It was determined independently by Dr. Calvert and myself as *minarum*, but is probably not the *minarum* of de Selys.—E. B. Williamson.

would have unhesitatingly believed that they represented at least four genera.[5]

The only single character which runs through the entire series is the absence of the internal soft fold. Probably the spines along the shaft are also a character of the entire group but they are so delicate that they have to be looked for specially, and in *laterale* and *adustum* I did not notice their absence until the drawings were assembled in the plate. Another character which runs through the entire group, but which is not so obvious, because it appears in a different form in each species, is one or more outgrowths (septa, lobes, spines, hooks, etc.) which appear along the median line of the dorsal or internal surface of the distal lobe. Outgrowths along this line, though they do occur in a few other genera, are rare. The singular paired outgrowths of the lateral edges of the distal segment, as they are developed in *temporale, apicale, gracile, ablutum, ascendens, kennedii, cuyabae,* and *truncatum,* are unusual, though they also appear in other genera. The strangest and least comprehensible development in the entire series is that of the pair of heavily chitinized hooks on the apex of the distal segment in *apicale* (Plate XVIII, fig. 3). A strong chitinization at this point is all but unique among the more than five hundred species of Zygoptera examined. The terminal soft fold varies in development in this series but I should hesitate to say that it was entirely absent in those species in which it is not figured, as it is at times gossamer-like and, if the specimen is the least dry clings so closely to the terminal segment that the most careful dissection may fail to loosen it. However I can state that it is as a rule poorly developed except in *cheliferum,* (Pl. XVIII, fig. 26).

The following brief notes are to amplify the characters shown in the figures on Plate XVIII.

*Acanthagrion ablutum* Calvert, figs. 10-11. The edges of segment 3, twisted at its base and turned in, form a pair of "shelves" between which is an ill-defined median septum.

[5]Prof. O. A. Johannsen has just called my attention to a condition similar to this in certain genera of Mycetophilidae. In some genera in this family the hypopygium in the male varies between species so much that the parts cannot be homologized.

*Acanthagrion adustum* Williamson, figs. 20-21. A thin septum-like, median, internal hook pointing distad on segment 3.

*Acanthagrion apicale* Selys., figs. 3-4. Segment 3 with a pair of heavy, chitinized, terminal hooks between which is a median globular swelling.

*Acanthagrion ascendens* Calvert, figs. 12-13. A median internal apical hook on segment 3.

*Acanthagrion cheliferum* Selys., figs. 26-27. An internal median swelling on segment 3. A thin, chitinized median hook on segment 2. Terminal fold well developed. The ridges in fig. 27 may have been due to the drying of the preparation.

*Acanthagrion cuyabae* Calvert, figs. 16-17. A median internal enlargement between the two lateral lobes of segment 3.

*Acanthagrion "gracile"* Rambur, figs. 8-9. Peculiar in that the tip of segment 3 is divided horizontally into three septa.

*Acanthagrion indefensum* Williamson, figs. 22-23. A delicate median, internal, barbed hook on segment 3.

*Acanthagrion interruptum* Selys., figs. 5-7. A median internal hook on segment 3. See fig. 7.

*Acanthagrion kennedii* Williamson, figs. 14-15. A thin septum along the median, internal line of segment 3.

*Acanthagrion laterale* Selys., figs. 18-19. The most simple of the series having merely an internal, median swelling to indicate its relationships.

*Acanthagrion temporale* Selys., figs. 1-2. A thin septum as in *kennedii*.

*Acanthagrion truncatum* Selys., figs. 24-25. A median internal hook formed by the turning in of the edges of segment 3.

In conclusion, certain venational characters divide this genus, as it has been understood in the past, but the penis, because of its evident great variety of forms, is of little assistance in defining groups among this series of species. However the study of the penis has shown very definitely that we are dealing with structurally, well defined species rather than with subspecies and varieties based, as hitherto, largely on color.

In addition I might say that I shall treat in another paper of a series of species in which a condition exists just opposite to this which occurs in *Acanthagrion*. In this other series what are apparently generically distinct species have almost identical penes.

EXPLANATION OF PLATE XVIII.

Drawings of the penes of the species of *Acanthagrion*, being lateral and ventral views of the last two segments.

Figs. 1-2, *Acanthagrion temporale*, Chapada, Matto Grosso, Brazil, det. P. P. Calvert.

Figs. 3-4, *Acanthagrion apicale*, Tumatumari, British Guiana, Feb. 10, 1912, det. E. B. Williamson.

Figs. 5-7, *Acanthagrion interruptum*, Concepcion, Chili, Jan., 1905, det. P. P. Calvert. Fig. 7 shows the median internal hook.

Figs. 8-9, *Acanthagrion "gracile,"* Gualan, Guatemala, June 14, 1905, det. E. B. Williamson.

Figs. 10-11, *Acanthagrion ablutum*, Coroico, Yungas, Bolivia, May 10, 1899, det. P. P. Calvert.

Figs. 12-13, *Acanthagrion ascendens*, Cunapo River, Trinidad, Feb. 27, 1912, det. E. B. Williamson.

Figs. 14-15, *Acanthagrion kennedii*, Cunapo River, Trinidad, Feb. 27, 1912, det. E. B. Williamson.

Figs. 16-17, *Acanthagrion cuyabae*, Cuyaba, Brazil, det. P. P. Calvert.

Figs. 18-19, *Acanthagrion laterale*, Bogotá, Columbia, Lindig, 1863, det. P. P. Calvert.

Figs. 20-21, *Acanthagrion adustum*, Wismar, Brit. Guiana, Feb. 15, 1912, collected by E. B. Williamson.

Figs. 22-23, *Acanthagrion indefensum*, Wismar, British Guiana, Feb. 16, 1912, collected by E. B. Williamson.

Figs. 24-25, *Acanthagrion truncatum*, Chapada, Matto Grosso, Brazil, det. P. P. Calvert.

Figs. 26-27, *Acanthagrion cheliferum*, Rio Grande do Sul, Brazil, H. von. Ihering, det. P. P. Calvert.

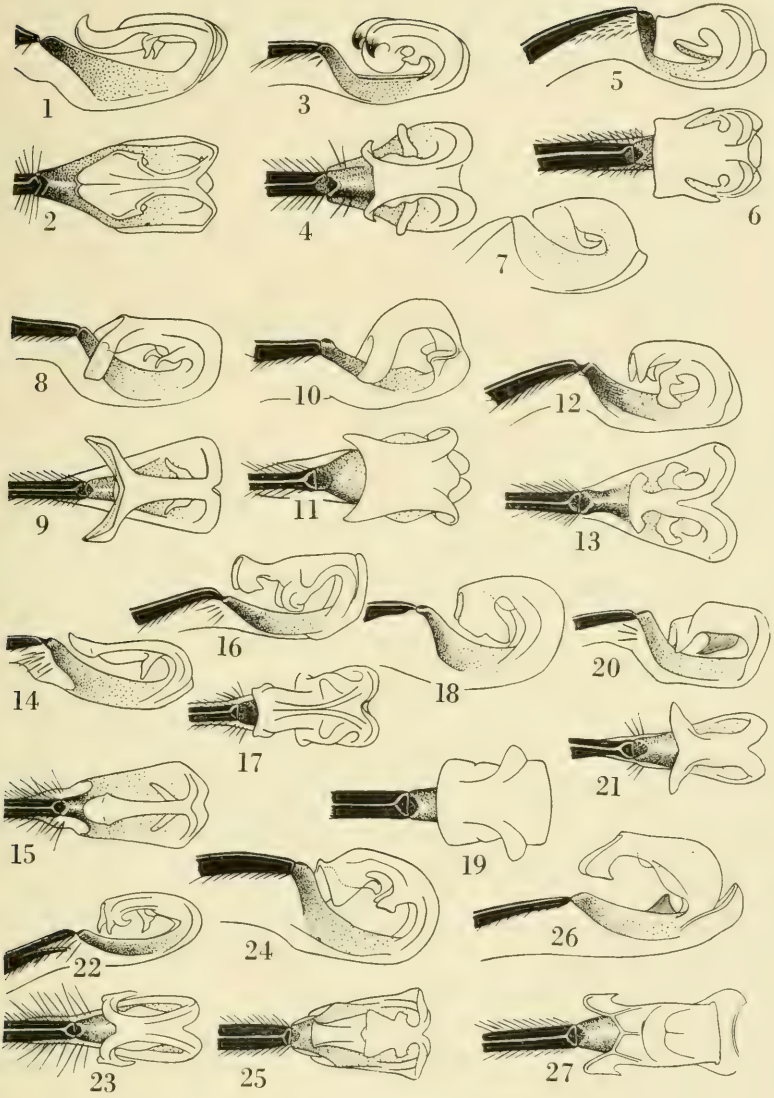
## An American Species of the Ichneumonid Genus Heterocola Förster (Hym.).

By CHARLES T. BRUES, Bussey Institution, Harvard University.

In 1890 Ashmead[1] erected the genus *Dolichopselephus* for a species of Porizontine Ophioninae with greatly elongated maxillary palpi. *Dolichopselephus* has recently been regarded by Szépligeti[2] as a synonym of *Heterocola* Förster, a genus represented by three European species. The characters given by him for *Heterocola* however, do not agree with those given by Ashmead for *Dolichopselephus* in several respects and it is evident that Szépligeti has been led by the peculiarly modified maxillary palpi to consider the two genera inseparable. They may be easily distinguished as follows:

Antennae with not over 20 joints; metathoracic spiracle lying very close to the pleural carina.....*Heterocola.*
Antennae consisting of 30 joints; metathoracic spiracle not lying next to the pleural carina .....*Dolichopselephus.*

[1] Bull. Colorado Biol. Assoc., No. 1. p. 23.
[2] Gen. Insec., Fasc. 34. p. 56 (1905).




PENES OF ACANTHAGRION.—KENNEDY.

I find in my collection a specimen from Forest Hills, Massachusetts, which is evidently a true *Heterocola* and establishes the occurrence of this genus in the Eastern United States. It is described below.

**Heterocola americana** sp. nov.

♀. Length 2.8 mm. Black, with the abdomen beyond the middle of the petiole ferruginous; scape below, mandibles, lower portion of clypeus, mouth-parts, tegulae and legs, including coxae, honey yellow, apical joint of palpi black; ovipositor concolorous with the abdomen, its sheaths piceous; wings tinged with brown, stigma and veins dark brown.

Head subopaque, very finely shagreened, more shining on the temples and distinctly so on the cheeks. Antennae 20-jointed, inserted midway between the vertex and base of clypeus; scape short, only half longer and no thicker than the pedicel; flagellum narrow at base, the first joint as long as the scape, but only half as thick; second joint two-thirds as long as the first, third and following thicker, those toward the middle a little longer than wide; clypeus shining, coarsely punctate. Mandibles long, nearly twice as long as the malar space and equalling the width of the eye; labrum elongated, pointed, as long as the eye and extending considerably beyond the anterior coxae; maxillary palpi with four subequal joints, reaching, when extended, almost to the middle coxae.

Mesonotum and scutellum opaque, shagreened, separated by a deep punctate groove which is terminated at the sides by a sharp carina that extends back over the basal angles of the very convex scutellum. Metathorax short, obliquely truncate, with a short basal median carina followed by a large area which includes the whole of the posterior slope of the metathorax; posterior lateral and pleural areas large, distinct; spiracle minute, circular, close to the anterior end of the pleural carina; surface of metathorax finely rugulose; pleurae shagreened.

Abdomen widest at the third segment, acutely narrowed apically; petiole slender, scarcely widened to beyond the middle, then suddenly wider, more gradually so near the apex, its spiracles just behind the middle; body of abdomen moderately compressed toward apex, its surface smooth and shining; ovipositor as long as the abdomen without the petiole.

Legs moderately slender. Wings with the transverse cubitus short, almost punctiform, recurrent nervure received just beyond it; third discoidal cell completely closed.

A single female from Forest Hills, Boston, Massachusetts, taken during September, 1913.

# ENTOMOLOGICAL NEWS.

PHILADELPHIA, PA., JULY, 1916.

### The Need of Carefulness in Identification.

One of the common complaints of the time in entomological, nay zoological circles is the difficulty of obtaining the aid of specialists to identify material. Every specialist becomes flooded, even overwhelmed, with the quantity of animals, of insects, which he is desired to determine. Delays of months or of years ensue and he who wishes his collections examined by competent authority must often send them to the one who will report on them the soonest, rather than to the one whose knowledge and carefulness are greatest. The conscientious specialist himself is obliged to decline to add to the tasks which the eager collector or museum officer presses upon him.

Under all the conditions, it is inevitable that some, not really fitted to identify species, take up the work without a full realization of all the safeguards to identification that honest work demands. It is not enough to compare specimens with others already tagged, it may be erroneously. Constant recourse must be had to original descriptions and to other published sources of exact information. Comparison of specimens is, indeed, important, for thereby the confounding of two or more forms under one name is discovered. The ultimate appeal is, of course, the comparison with types, but few of us have access to these courts of last resort.

The constant checking up of new material, as well as that previously determined (including types where possible), *with the literature* is the obvious duty of everyone who undertakes to pass definitely on the systematic status of speciments of natural history.

### A Correction for Parnassius smintheus (Lep.).

I chanced to see a recent issue of ENTOMOLOGICAL NEWS last night, and noticed under your article on *Parnassius* that I am quoted (Vol. xxvii, page 213) as recording *smintheus* from south*east* of Calgary. This should be south*west*. The correction is rather important as everywhere southeast of Calgary is open prairie; there the species is not in the least likely to occur.—F. H. WOLLEY DOD.

**A Remarkable Abdominal Structure in Certain Moths (Lepid.).**

In *Papilio,* III, 41, 1883, R. H. Stretch published an article entitled "Anal Appendages of *Leucarctia acraea*" and figured the appendages. In Entomological News, XXVI, 166, 1915, F. W. Russell, M.D., published a paper entitled "A Remarkable Abdominal Structure in Certain Moths." This also was illustrated. Both observers described this curious organ in *acraea.* The species is a common one and the insect evidently only protrudes the organ on special occasions, otherwise it would be more commonly observed. At the time Dr. Russell made his observation he was not aware that the organ had been previously known and described.*—Henry Skinner.

# Entomological Literature.

COMPILED BY E. T. CRESSON, JR., AND J. A. G. REHN.

Under the above head it is intended to note papers received at the Academy of Natural Sciences, of Philadelphia, pertaining to the Entomology of the Americas (North and South), including Arachnida and Myriopoda. Articles irrelevant to American entomology will not be noted; but contributions to anatomy, physiology and embryology of insects, however, whether relating to American or exotic species, will be recorded.

The numbers in **Heavy-Faced Type** refer to the journals, as numbered in the following list, in which the papers are published.

All continued papers, with few exceptions, are recorded only at their first installments.

The records of papers containing new species are all grouped at the end of each Order of which they treat. Unless mentioned in the title, the number of the new species occurring north of Mexico are given at end of title, within brackets.

For records of Economic Literature, see the Experiment Station Record, Office of Experiment Stations, Washington. Also Review of Applied Entomology, Series A, London. For records of papers on Medical Entomology, see Review of Applied Entomology, Series B.

**1**—Proceedings, Academy of Natural Sciences of Philadelphia. **4**—The Canadian Entomologist. **9**—The Entomologist, London. **11**—Annals and Magazine of Natural History, London. **16**—Bulletin, Societe Nationale d'Acclimatation de France, Paris. **50**—Proceedings, U. S. National Museum. **51**—Novitates Zoologicae, Tring, England. **60**—Anales, Museo Nacional de Buenos Aires. **79**—La Nature, Paris. **86**—Annales, Societe Entomologique de France, Paris. **161**—Proceedings, Biological Society of Washington. **177**—Quarterly Journal of Microscopical Science, London. **184**—Journal of Experimental Zoology, Philadelphia. **206**—The Scottish Naturalist, Edinburgh. **259**—Publications, Carnegie Institution of Washington. **272**—Memorias, Real Academia de Ciencias y Artes de Barcelona. **285**—Nature Study Review, Ithaca, N. Y. **291**—Proceedings, Staten Island Association of Arts and Sciences. **447**—Journal of Agricultural Research, Washington.

* See also *Papilio,* III, 84, 1883.

**475**—Bulletin, Societe Vaudoise des Sciences Naturelles. **490**—The Journal of Parasitology, Urbana, Illinois. **524**—Technical Bulletins, Entomology, University of California, Berkeley. **529**—Journal of Zoological Research, London. **530**—Memoires, Societe des Sciences Naturelles de Neuchatel.

**GENERAL SUBJECT.** **Hegner, R. W.**—Gall insects and insect galls, **285,** xii, 201-12. **Pictet, A.**—A propos des tropismes. Recherches experimentales sur le comportement des insectes vis-a-vis des facteurs de l'ambiance, **475,** 1, 423-548. **Young, R. T.**—Some experiments on protective coloration, **184,** xx, 457-508.

**PHYSIOLOGY AND EMBRYOLOGY.** **Morgan & Bridges**—Sex-linked inheritance in Drosophila, **259,** No. 237, 87 pp.

**MEDICAL.** **Britton, W. E.**—The house fly as a disease carrier and how controlled. 12 pp. (Connecticut State Board of Health, 1916.) **Coupin, H.**—Le danger des moustiques pendant la guerre, **79,** 1916, 295-9.

**ARACHNIDA, ETC.** **Herms, W. B.**—The pajaroello tick (Ornithodorus coriaceus), **490,** ii, 139-44.

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**Brolemann, H. W.**—Essai de classification des Polydesmiens, **86,** 1915, 523-610. **Carl, J.**—Die Diplopoden von Columbien nebst beitragen zur morphologie der Stemmaloniliden, **530,** v, 821-993. **Kraepelin, K.**—Beitrag zur kenntnis der skorpione und pedipalpen Columbiens, **530,** v, 15-28. **Ribaut, H.**—Contribution a l'etude des Chilopodes de Colombie, **530,** v, 67-95. **Strand, E.**—Spinner der familien Sparassidae, Lycosidae, Sicariidae und Pholcidae aus Kolumbien, **530,** v, 810-20.

**NEUROPTERA, ETC.** **Brethes, J.**—Descripcion de un genero nuevo y una nueva especie de Tisanoptero de la Rep. Argentine, **60,** xxvii, 89-92. **Hood, J. D.**—Descriptions of new Thysanoptera [8 new], **161,** xxix, 109-124. **Longinos Navas, R. P.**—Neuropteros nuevos o poco conocidas (Ser. vi-vii), **272,** xii, 119-36; 219-43.

**ORTHOPTERA.** **Foucher, G.**—Etudes biologiques sur quelques Orthopteres, **16,** 1916, 116-22.

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**Brethes, J.**—Un nouvel O. de la Republic Argentine, **60,** xxvii, 333-34. **Rehn & Hebard**—Studies in the Dermaptera and Orthoptera of the costal plain and Piedmont region in the southeastern U. S. [9 new], **1,** lxviii, 87-314.

**HEMIPTERA.** **Gibson, E. H.**—Some 1915 notes on a few common Jassoidea in the central Mississippi valley states, **4,** 1916, 177-9.

**Imms, A. D.**—Observations on the insect parasites of some Coccidae, **177,** lxi, 217-74.

**Baker & Davidson**—Woolly pear aphis (Eriosoma pyricola n. sp.), **447,** vi, 351-60. **Van Duzee, E. P.**—Notes on some Hemiptera taken near Lake Tahoe, California [13 new], **524,** i, 229-49.

**LEPIDOPTERA. Bailey, J.**—School room experiences with the cecropia moth, **285,** xii, 226-29. **Davis, W. T.**—Notes on the Microlepidoptera of Staten Island, II, **291,** v, 94-7. **Whittle, F. G.**—L. from the Argentine and Canada, **9,** 1916, 106-8. **Wolley Dod, F. H.**—The Heath collection of L., **4,** 1916, 161-67 (cont.).

**Giacomelli, E.**—Algunas novedades de lepidopterologia argentina, **60,** xxvii, 356-364. **Rothschild & Jordan**—Corrections of and additions to our "Revision of the Sphingidae," **51,** xxiii, 115-23. **Schaus, W.**—A generic revision of the American moths of the subfamily Hypeninae with descriptions of new genera and sps., **50,** I, 259-399.

**DIPTERA. Ashworth, J. H.**—A note on the hibernation of flies, **206,** 1916, 81-4. **Grimshaw, P. H.**—The study of D., **206,** 1916, 85-8. **Patten, B. M.**—The changes of the blowfly larva's photosensitivity with age, **184,** xx, 585-97.

**COLEOPTERA. Barbey, A.**—Biologie du Cerambyx heros, **475,** I, 621-36. **Davis, W. T.**—A beneficial beetle (Carabus nemoralis) recently found on Staten Island, **291,** v, 92-3. **Harris & Leng**—The Cicindelinae of N. Am. as arranged by Dr. Walther Horn in Genera Insectorum (distributed by Am. Mus. N. Hist., 1916), 23 pp. **Payne, O. G. M.**—On the life-history and structure of Telephorus lituratus, **529,** i, 4-32. **Simanton, F. L.**—Hyperaspis binotata, a predatory enemy of the terrapin scale, **447,** vi, 197-203.

**HYMENOPTERA. Brethes, J.**—A proposito de la nota del doctor F. Lahille sobre Prospaltella berlesei; Hymenopteres parasites de l'Amerique meridionale, **60,** xxvii, 353-58; 401-30. **Good, C. A.**—A few observations on the apple maggot parasite—Biosteres rhagoletis, **4,** 1916, 168. **Lahille, F.**—Nota sobre Prospaltella berlesei, **60,** xxvii, 111-26. **Packard, C. M.**—Life histories and methods of rearing hessian-fly parasites, **447,** vi, 367-81.

**Crawley, W. C.**—Ants from British Guiana, **11,** xvii, 366-78. **Forel, A.**—Quelques fourmis de Colombie, **530,** v, 9-14. **Girault, A. A.**—A new Phanurus from the U. S., with notes on allied species, **4,** 1916, 149-50. **Santschi, F.**—Descriptions de fourmis nouvelles d'Afrique et d'Amerique—Fourmis de l'Argentine, **86,** 1915, 509-13.

THE LIFE OF INLAND WATERS. An elementary text book of fresh-water biology for American students. By JAMES G. NEEDHAM, Professor, and J. T. LLOYD, Instructor, in Limnology in Cornell University. 1916. The Comstock Publishing Company, Ithaca, New York. 9¼ x 6½ inches, 438 pp., 242 figs., 19 initials and tail pieces. Price $3.00.

This book has developed in connection with the course in general limnology at Cornell University, begun in 1906. Its scope is naturally much wider than that of entomology, but insects figure largely in its pages. After an historical introduction (Chap. I, pp. 13-24), the nature and types of aquatic environment are described (Chaps. II, III, pp. 25-99). Under Chapter IV, Aquatic Organisms, pages 100-158 are concerned with plants and pages 158-241 with animals; of the latter section, the insects occupy pages 195-230, with 37 figures. Owing to limitations of space, smaller taxonomic groups than families are not considered. Perhaps the most interesting part of the book is Chapter V, Adjustment to Conditions of Aquatic Life (pp. 242-292), such as flotation, improvement of form, avoidance of silt; withstanding the wash of moving waters, etc., etc. Aquatic Societies, both limnetic and littoral, are discussed in Chapter VI (pp. 293-375), which vies with its predecessor in attractiveness. Finally, Inland Water Culture is treated in Chapter VII (pp. 377-412). There is a bibliography under author's names arranged alphabetically (pp. 413-419) and an index (pp. 421-438).

As mentioned above, the insects are formally treated in Chapter IV, but many other references to them occur in subsequent pages. The reader will not find in this volume any keys to the identification of aquatic organisms but the numerous figures and the text will enable him to become acquainted with the names, habits and environmental relations of many plants and animals associated with any group of water beings in which his interest chiefly lies. "It is the ecologic side of the subject rather than the systematic or morphologic, that we have emphasized," say the authors, and every entomologist looking into this book will be the better for such a consideration of aquatic life as he will find here.

The text is pleasingly written, the type is clear and large, the illustrations useful or beautiful. We must, however, utter a protest against a fault too common with our American books. This volume is too heavy; it weighs 38 ounces, a quality which has already discouraged us from carrying it with us to while away an enforced wait when reading was almost the only resource. The common practice of printing half-tones in the midst of the text, with the use of coated paper throughout, is the responsible cause.—P. P. C. (*Adv.*)

# EXCHANGES.

**This column is intended only for wants and exchanges, not for advertisements of goods for sale. Notices not exceeding three lines free to subscribers.**

☞ These notices are continued as long as our limited space will allow; the new ones are added at the end of the column, and only when necessary those at the top (being longest in) are discontinued

**Wanted for cash**—Lucanidae in perfect condition.—Joseph Brunner, Missoula, Montana.

**For exchange**—Entomological News, 1909, 1910, 1911, also Zeitschrift für wissenschaftliche Insecten Biologie, 1910, 1911, 1912.—Henry Wormsbacher, 1357 St. Charles Ave., Lakewood, Ohio.

**Wanted**—12 pair of *Argynnis idalia*, 3 pair *Arg. diana*, 2 pair *Arg. edwardsii* for exchange or cash.—A. F. Porter, Decorah, Iowa.

**Wanted**—Will pay cash for fertile females of the genus *Eubaphe* or give other Lepidoptera in exchange. Specimens from west and northwest especially desired. Write for details.—Alex. Kwiat, 2445 Eastwood Ave., Chicago, Ill.

**Orthoptera**—Especially from the mid-west examined for collectors. Correspondence invited.—M. P. Somes, Box 226, Mountain Grove, Mo.

**Wanted for Cash** or will give liberal exchange for Cetonidae of North, South and Central America. Send in your list.—Frank J. Psota, 316 So. Mozart St., Chicago, Ill.

**Wanted**—Fertile eggs of *A. luna*, *C. angulifera* and *Triptogon modesta;* preferably in exchange for better *Catocalae* (*lacrymosa*, etc.), and other St. Louis material.—F. T. Naumann, 1000 Washington Ave., St. Louis, Mo.

**Wanted**—*Catocala* from the Western and Southern States, and Cynipidae and their galls from all parts of North America. Will identify species in return for specimens.—William Beutenmuller, 879 Whitlock, Ave., Bronx, New York, N. Y.

**Wish to exchange** Cicindelidae from my locality and Indiana for American and exotic Cicindelidae new to my collection.—Adolph Mares, 2524 So. Homan Ave , Chicago, Ill.

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